Configuring ATM Services

Router Software Version 10.0
Site Manager Software Version 4.0

Software Version BNX 6.0
Site Manager Software Version BNX 6.0

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About This Guide

This guide offers

- A general overview of Asynchronous Transfer Mode (ATM) technology and a list of additional resources that describe ATM (Chapter 1)
- Specific features of ATM DXI (Data Exchange Interface) and how we implement them (Chapter 2)
- Instructions for enabling ATM DXI on an interface (Chapter 3)
- Descriptions of ATM DXI parameters and how to edit them (Chapter 4)
- Specific features of ATM and how we implement them (Chapter 5)
- Instructions for enabling ATM on an interface (Chapter 6)
- ATM editing basics including methods of accessing various ATM parameter windows, where and how to edit bridging and routing protocols for an ATM virtual circuit, and different ways to delete ATM (Chapter 7)
- Descriptions of ATM service record and interface parameters and how to edit them (Chapter 8)
- Descriptions of ATM signaling and interim local management interface (ILMI) parameters and how to edit them (Chapter 9)
- A list of parameter default settings for ATM DXI and ATM (Appendix A)
- LAN emulation overview (Appendix B)
- An example of how to define an ATM logical IP subnet (Appendix C)
- An example of how to set up an ATM network using Bay Networks™ switching and routing equipment (Appendix D)
- A sample ATM log (Appendix E)

Audience

If you are responsible for configuring and managing ATM on Bay Networks routers, read this guide to discover how to use Site Manager software to customize ATM DXI and ATM services to suit your environment.

Before You Begin

Before using this guide, you must complete the following procedures:

- Create and save a configuration file that has at least one ATM DXI or ATM interface.
- Retrieve the configuration file in local, remote, or dynamic mode.

Refer to *Configuring Routers* for instructions.

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Conventions

arrow character (➔)	Separates menu and option names in instructions. Example: Protocols➔AppleTalk identifies the AppleTalk option in the Protocols menu.
bold text	Indicates text that you need to enter and command names in text. Example: Use the **dinfo** command.
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
quotation marks (“ ”)	Indicate the title of a chapter or section within a book.
`screen text`	Indicates data that appears on the screen. Example: `Set Bay Networks Trap Monitor Filters`

vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **show at routes** | **nets**, you enter either **show at routes** or **show at nets**, but not both.

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Acronyms

AAL	ATM Adaptation Layer
ALC	Adaptation Layer Controller
ARE	ATM Routing Engine
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband Integrated Services Digital Network
BUS	broadcast and unknown server
CPCS	common part convergence sublayer
CS	convergence sublayer
CSU	channel service unit
DCE	data communications equipment
DSU	data service unit
DTE	data terminal equipment
DXI	data exchange interface
FRE	Fast Routing Engine
ILI	intelligent link interface

ILMI	interim local management interface
IP	Internet Protocol
ITU-T	International Telecommunications Union – Telecommunication Standardization Sector
LANE	LAN emulation
LE	LAN emulation
LEC	LAN emulation client
LECS	LAN emulation configuration server
LES	LAN emulation server
MAC	Media Access Control
MTU	Maximum Transmission Unit
NMA	network management application
NMS	network management station
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PDU	protocol data unit
PVC	permanent virtual circuit
RIP	Routing Information Protocol
SAP	service access point
SAR	segmentation and reassembly
SDH	Synchronous Digital Hierarchy
SDU	service data unit
SMDS	Switched Multimegabit Data Services
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SRM	system resource module
SSCOP	Service Specific Connection Oriented Protocol
SSCS	Service Specific Convergence Sublayer
SVC	switched virtual circuit
UNI	user-network interface
VCC	virtual channel connection
VCI	virtual channel identifier

VCL	virtual channel link
VPC	virtual path connection
VPI	virtual path identifier
WAN	wide area network

Chapter 1
ATM Overview

Asynchronous Transfer Mode (ATM) is a connection-oriented, cell-based technology that relays traffic across a Broadband Integrated Services Digital Network (B-ISDN). It is a cost-effective way of transmitting voice, video, and data across a network.

ATM Cell

An ATM cell is a short, fixed-length packet of 53 bytes. It consists of a 5-byte header containing address information and a fixed, 48-byte information field. Figure 1-1 shows a diagram of an ATM cell.

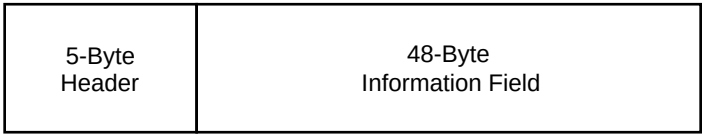


Figure 1-1. ATM Cell

Using a fixed-length cell size allows you to predict network delays, making ATM suitable for carrying real-time information (for example, voice and video) as well as data.

ATM allows the network to operate at a much higher rate than typical packet-switching systems (for example, X.25), because it provides no error protection or flow control. Instead, ATM relies on the source and destination devices to perform error-recovery functions such as retransmission of lost packets.

Cell Header

After dividing the data into 48-byte segments for transmission, the end device (that is, the ATM DSU/CSU or native ATM device) attaches the required header information (Figure 1-2).

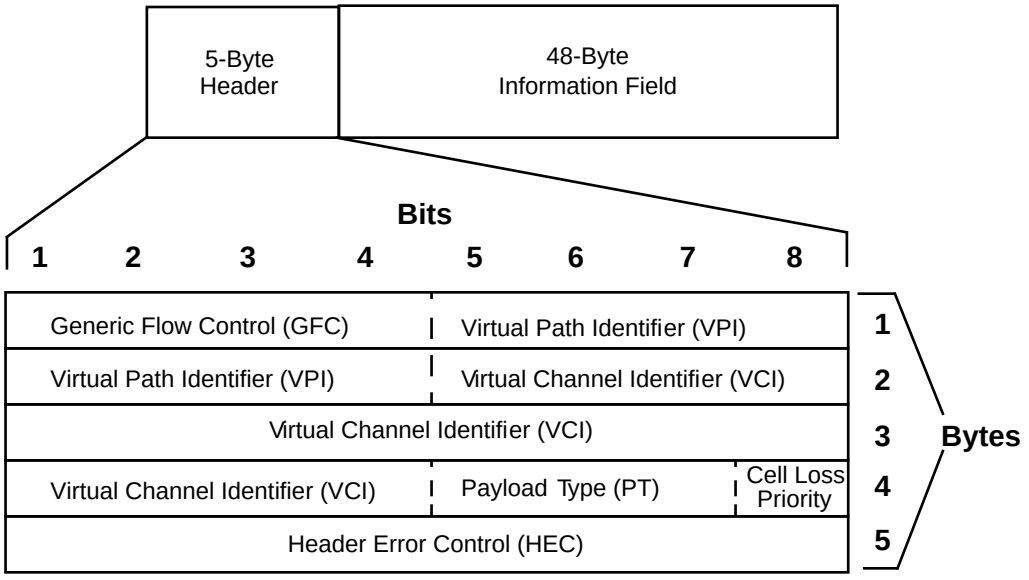


Figure 1-2. ATM Cell Header

The fields in each ATM cell header provide all the information necessary for networking. These fields include the following:

- **Generic Flow Control (GFC)**: The first 4 bits of the cell header contain the GFC. The GFC controls traffic flow onto the ATM network by controlling the user-network interface (UNI).
- **Virtual Path Identifier (VPI)**: The next 8 bits of the cell header (that is, the last half of byte 1 and the first half of byte 2) contain the VPI. The VPI specifies a virtual path on the physical ATM link. Refer to the “Data Transmission” section, later in this chapter, for additional information on virtual paths.

- **Virtual Channel Identifier (VCI)**: The next 16 bits of the cell header (that is, the last half of byte 2, all of byte 3, and the first half of byte 4) contain the VCI. The VCI specifies a virtual channel within the virtual path on the physical ATM link. Refer to the “Data Transmission” section, later in this chapter, for additional information on virtual channels.
- **Payload Type (PT)**: The next 3 bits (that is, bits 5 through 7 of byte 4) indicate the type of information the cell is carrying (for example, user data or management information).
- **Cell Loss Priority (CLP)**: The last bit of byte 4 indicates the priority of the cell and whether the network can discard it under heavy traffic conditions. Setting the bit to 1 indicates the network may discard the cell if necessary.
- **Header Error Control (HEC)**: The last byte of the header field contains the HEC. Its primary function is to guard against misdelivery of cells due to header or single bit errors. However, the HEC does not gauge the quality of the data in the information field.

Cell Information Field

Following the 5-byte cell header is a 48-byte information field containing user data. The ATM Adaptation Layer (AAL) organizes the data in this field. Refer to the following section, “ATM Layers,” for additional information about the AAL.

ATM Layers

The B-ISDN protocol reference model, on which ATM is based, consists of four layers. Each layer communicates only with the layers directly above it or directly below it. Figure 1-3 shows the B-ISDN ATM protocol reference model.

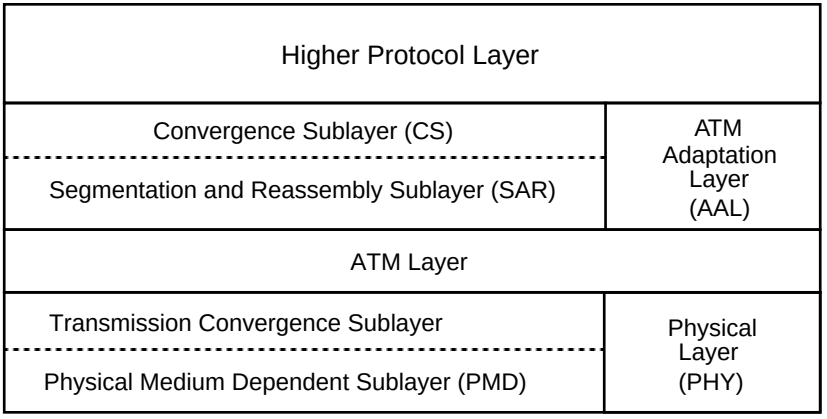


Figure 1-3. B-ISDN ATM Protocol Reference Model

The following layers relate directly to how Bay Networks routers support ATM DXI and ATM FRE2:

- ATM layer
- ATM adaptation layer (AAL)

The *ATM layer* defines how two nodes transmit information between them. It is concerned with the format and size of the cells and the contents of the headers. The addresses of the cells are meaningful only to the two adjacent local nodes (that is, usually not to the end nodes).

The *ATM adaptation layer (AAL)* converts higher-layer protocol data into formats that are compatible with the requirements of the ATM layer, enabling ATM to handle different types of information all within the same format.

The AAL is divided into two sublayers: the *Convergence Sublayer (CS)* and the *Segmentation and Reassembly (SAR) Sublayer*. These two sublayers convert variable-length messages into 48-byte segments, while ensuring the integrity of the data.

The CCITT (now ITU-T) has defined different types of AALs to handle different kinds of traffic. Bay Networks routers support AAL 3/4 and AAL 5. The next two sections describe the AAL process.

AAL 3/4

In the AAL 3/4 process, a Convergence Sublayer (CS) header and trailer envelop the data from the higher layer protocols, creating a CS protocol data unit (PDU).

AAL 3/4 divides the PDU into 44-octet segments. Each segment is encapsulated with a segmentation and reassembly (SAR) header and trailer, creating a 48-octet SAR PDU. This 48-octet SAR PDU is the payload of the ATM cell (Figure 1-4).

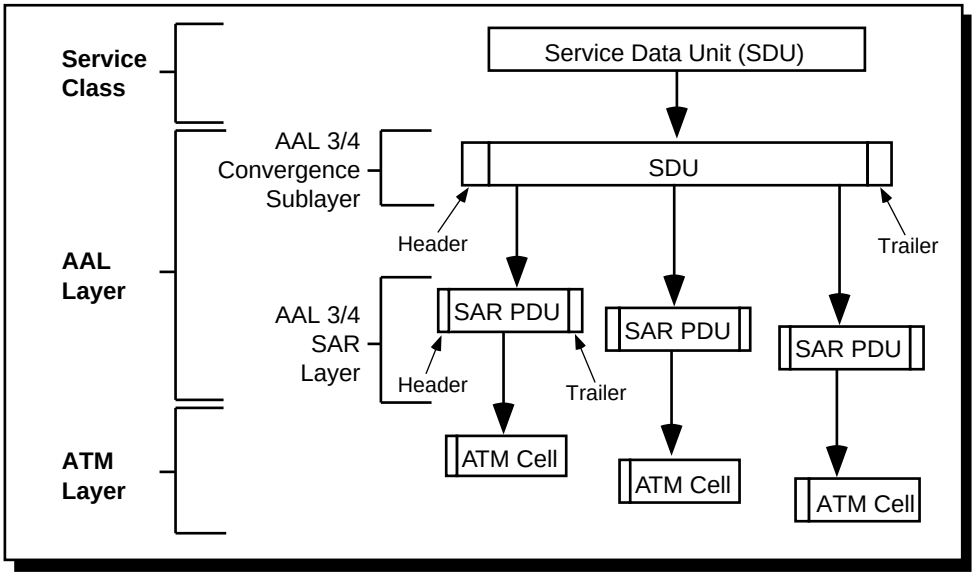


Figure 1-4. ATM Adaptation Layer 3/4

AAL 5

In AAL 5, only a trailer attaches to the data from the higher layer protocols to create a CS PDU. AAL 5 divides the PDU into a 48-octet SAR PDU; however, it does not add an SAR header and trailer. This 48-octet SAR PDU becomes the payload of the ATM cell (Figure 1-5).

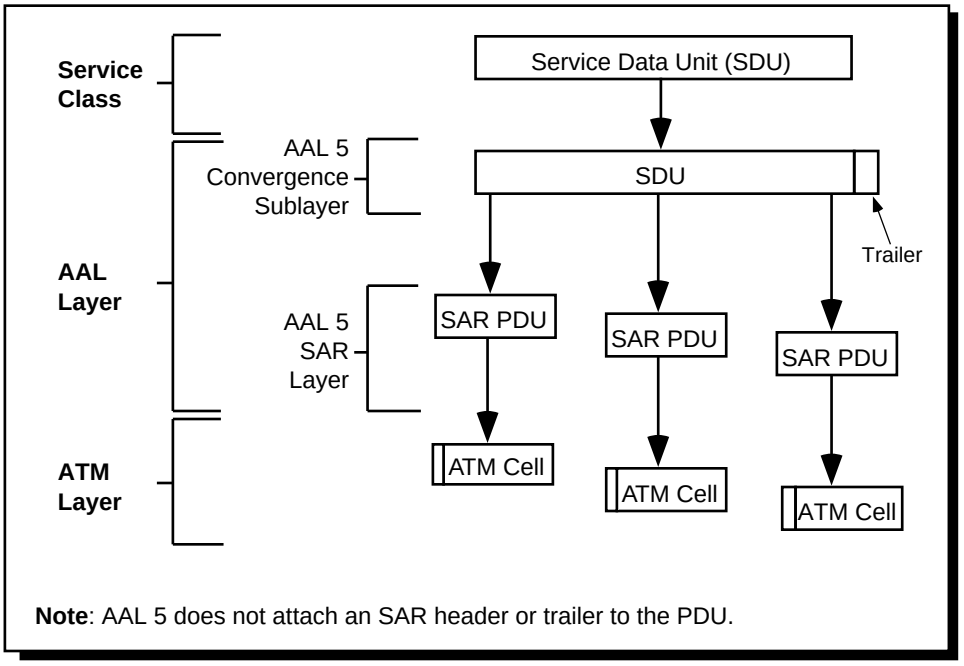


Figure 1-5. ATM Adaptation Layer 5

Data Transmission

Data transmission (also called *cell switching*) through the ATM network relies on the establishment of logical connections between ATM entities. ATM is a *connection-oriented* service. This means that an ATM entity cannot transmit information until it establishes a connection with a receiving entity. These connections consist of *virtual channels*, *virtual paths*, and *transmission paths*.

A virtual channel is a logical connection between two communicating ATM entities. Each virtual channel may carry a different protocol or traffic type. The virtual channel transports cells that have a common identifier. The identifier is called the virtual channel identifier (VCI) and is part of the cell header. You can establish virtual channels permanently or set them up dynamically, allowing the network to adjust itself to the traffic demand.

A virtual path is a set of virtual channels between a common source and destination. The virtual channels in a virtual path logically associate to a common identifier. This identifier is called the virtual path identifier (VPI) and is part of the cell header. You can base cell switching on either the VPI alone, or on a combination of the VPI and VCI.

Virtual paths enable you to separate network transport functions into those related to an individual logical connection (virtual channel) and those related to a group of logical connections (virtual path).

A transmission path is a physical connection that comprises several virtual paths, each virtual path containing several virtual channels. The transmission path may support multiple virtual paths across a single connection to the network.

Figure 1-6 shows the relationships between the virtual channel, the virtual path, and the transmission path.

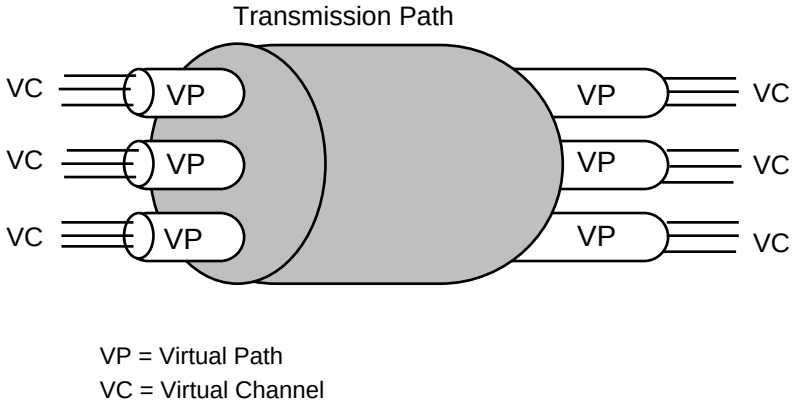


Figure 1-6. ATM Transmission Components

Permanent and Switched Virtual Connections

Virtual channels and virtual paths allow you to establish virtual channel links (VCLs). You can create VCLs as either permanent virtual circuits (PVCs) or switched virtual circuits (SVCs). Once you establish a PVC, you can transfer information over it at any time. Switched virtual circuits only activate, through signaling and network switching, when there is information ready for transmission.

ATM DXI versus ATM

You can access an ATM network using either a synchronous link module running ATM data exchange interface (DXI) or an ATM link module. However, each method provides access in a different way.

A synchronous link module works in conjunction with a Fast Routing Engine (FRE® or FRE-2) to form an intelligent link interface (ILI) pair. This ILI pair uses ATM DXI as a wide area network (WAN) protocol.

ATM DXI allows you to configure an interface on a synchronous interface to access an ATM network through an ATM DSU/CSU. In other words, the router transfers variable-length ATM DXI packets to the DSU/CSU. The DSU/CSU then converts these packets into uniform 53-byte cells for transmission over the ATM network.

For additional information about ATM DXI and how to customize your ATM DXI interface, refer to Chapters 2, 3, and 4.

ATM link modules interact with specific processor modules to form intelligent link interface (ILI) pairs. These ILI pairs provide the connection and processing that allow you to connect directly to an ATM network.

An ATM FRE2 link module works in conjunction with a Fast Routing Engine (FRE-2) processor, and an ATM Routing Engine link module works with an ATM Routing Engine (ARE) processor. These ILI pairs process variable-length packets into uniform, 53-byte cells, and transmit them directly onto the ATM network.

For additional information about direct ATM connection and how to customize your ATM interface, refer to Chapters 5, 6, 7, 8, and 9.

For More Information

For more information about ATM, refer to the following documents:

ATM Forum. *ATM Data Exchange Interface Specification*. Version 1.0. August 1993.

ATM Forum. *ATM User-Network Interface Specification*. Version 3.0. September 1993.

ATM Forum. *LAN Emulation Over ATM*. Version 1.0. January 1995.

Bellcore Document SR-NWT-001763, Issue 1. *Preliminary Report on Broadband ISDN Transfer Protocols*. December 1990.

———, FA-NWT-001109. *Broadband ISDN Transport Network Elements Framework Generic Criteria*. December 1990.

———, FA-NWT-001110. *Broadband ISDN Switching System Framework Generic Criteria.* December 1990.

Bradley, T., Brown, C., and Malis, A. *Multiprotocol Interconnect over Frame Relay.* RFC 1294. Network Working Group. January 1992.

De Prycker, M. *Asynchronous Transfer Mode: Solution for Broadband ISDN*. Ellis Horwood Limited, 1991.

Grossman, D., Hoffman, E., Liaw, F., Malis, A., Mankin, A., and Perez, M. *ATM Signaling Support for IP over ATM*. RFC 1755. Network Working Group. February 1995.

Handel, R. and Huber, M. *Integrated Broadband Networks: An Introduction to ATM-Based Networks*. Reading, Massachusetts: Addison-Wesley Publishing Company, 1991.

Heinanen, J. *Multiprotocol Encapsulation over ATM Adaptation Layer 5*. RFC 1483. Network Working Group. July 1993.

ITU-T. *B-ISDN - ATM Adaptation Layer - Service Specific Connection Oriented Protocol (SSCOP)*. Final Draft. March 10, 1994.

Laubach, M. *Classical IP and ARP over ATM*. RFC 1577. Network Working Group. January 1994.

Chapter 2
ATM DXI Features and Implementation Notes

ATM DXI (Data Exchange Interface) allows a link module with a synchronous interface (that is, HSSI, V.35, or RS-449) to connect to an ATM network through an ATM DSU/CSU (Figure 2-1).

When the router transfers data to the DSU/CSU, the DSU/CSU converts variable-length packets into uniform 53-byte cells for transmission over the ATM network.

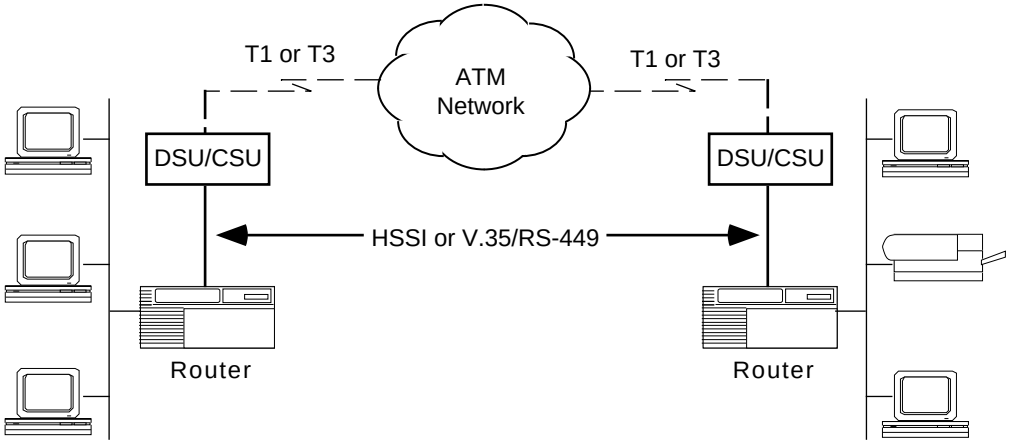


Figure 2-1. ATM DXI

Before you customize ATM DXI for your router

- Read about the kinds of support that a router running ATM DXI provides
- Review the notes describing how Bay Networks implements special ATM DXI features.

ATM DXI Support

A router running ATM DXI provides the following support:

- Routing of IP, IPX, XNS, DECnet Phase IV, AppleTalk, and VINES traffic over the ATM network
- MAC-level transparent bridging over the ATM network
- Multiprotocol encapsulation functions defined in RFC 1294 and RFC 1483 that enable concurrent bridging and multiprotocol routing support on the same PVC
- A Convergence Sublayer function compatible with AAL 3/4 and AAL 5 as defined in Section 1 of the CCITT (now ITU-T) *B-ISDN Protocol Reference Model* (PRM)
- Error checking
- ATM DXI Link Management Interface (LMI), including SNMP Proxy support. This is a proprietary version of the LMI and is available only when using the Mode 2 Proprietary DXI encapsulation with a Digital Link DSU/CSU.
- Broadcasting and multicasting support
- ARP and Inverse ARP support

The DSU/CSU supports the following layers:

- Segmentation and Reassembly (SAR) sublayer of the AAL
- ATM layer defined in the B-ISDN PRM
- Physical layer interface to the ATM network through DS1 and DS3

Multiprotocol Encapsulation

Multiprotocol encapsulation enables the router to multiplex and demultiplex bridged or routed protocol data units (PDUs).

For transmission, this function adds a header between 2 and 8 octets in length to the PDU to allow decoding. The decoding process determines the proper Service Access Point (SAP).

When receiving packets, this function evaluates the header to determine whether the PDU is a valid routed or bridged packet. If it is valid, this function then strips the header from the packet and passes it to the appropriate SAP for routing or bridging.

AAL Sublayer Support

The CS in the router logically connects to the SAR in the DSU/CSU using a common interface defined by the ATM DXI protocol. The ATM DXI protocol interface transfers PDUs between the CS and the SAR. Figure 2-2 shows the functional division of the AAL sublayers between the router and the DSU/CSU.

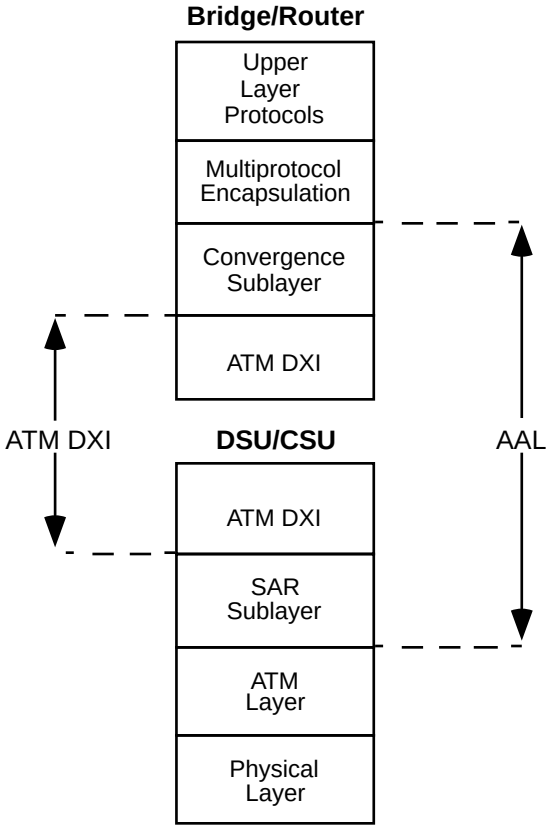


Figure 2-2. AAL Layer Division between Bridge/Router and DSU/CSU

ATM DXI Error Checking

The ATM DXI verifies that the VPI/VCI is valid for the PVCs configured for that ATM circuit. It also verifies the header format as defined by the value of the DXI Mode parameter. Refer to the "ATM DXI Modes of Operation" section, later in this chapter, for details.

ATM DXI also verifies that the BTag field in the CS_PDU header is equal to the ETag field in the CS_PDU trailer and ensures that the frame size is valid. If the packet contains an invalid header, the router drops the packet, updates the appropriate MIB statistic, and logs the appropriate event.

Note: *The ETag and BTag fields verify that the reassembled AAL3/4 Common Part Convergence Sublayer (CPCS) frame is not just two frames concatenated together. If these two fields do not match, then the frame is most likely the concatenation of two frames.*

ATM DXI LMI Support

The router supports a proprietary version of the ATM DXI Local Management Interface (LMI). This proprietary version of the LMI was a precursor to the standardized ATM Forum version.

LMI uses an SNMP-like protocol to query network management statistics maintained on the DSU/CSU MIB. The DSU/CSU may also send asynchronous events in the form of trap messages to the router.

Simulated Multicast Packet Support

The ATM DXI interface supports multicast packets, enabling the router to take advantage of multicast functionality, if it is available from the ATM network. ATM multicasting reserves selected network-assigned VPIs/VCIs as multicast addresses. The ATM network maps multiple recipients to a single VPI/VCI and delivers copies of all ATM cells to each member of the address group. As a cell passes through the ATM network, the network manipulates the cell to reveal the actual source to the cell recipient.

If no multicast address is available for the protocol (because the network interface has direct PVC access, you have not set up the service yet, or the VPI/VCI has not been entered in the Adjacent Host Table), ATM DXI simulates a broadcast packet by forwarding a copy of the message to each known PVC.

Simulated multicasting is generally used in certain address resolution techniques and for applications that require the delivery of identical information to multiple recipients.

ARP and Inverse ARP Support

ATM DXI supports the ARP protocol, enabling the router to dynamically resolve IP network layer protocol-to-VPI/VCI address mappings. ATM DXI learns the PVC address by detecting the PVC that received the ARP response.

ATM DXI also supports the Inverse ARP protocol. However, you can only use Inverse ARP if both the local and remote router support it.

Bay Networks uses proprietary methods for ARP and Inverse ARP. These methods are not compatible with third-party equipment (that is, equipment using the specifications in RFC 1577).

ATM DXI Implementation Notes

This section describes special features regarding how Bay Networks implements ATM DXI.

Configuring Synchronous Lines for ATM DXI

If you enable ATM DXI on a circuit, Site Manager automatically sets synchronous line parameters as follows:

Parameter	Value
BOFL	Disable
Promiscuous	Enable
Service	Transparent
WAN Protocol	ATM DXI

For more information about these parameters, refer to *Configuring Line Services*.

ATM DXI Modes of Operation

The ATM Forum's ATM DXI specification defines three modes of operation. Each mode specifies a different set of operations and data transfer between the DTE, the router, the DCE, and the DSU/CSU. The combination of the router link module and the DSU/CSU provides a User-Network Interface to the ATM network.

The modes of operation include the following:

Mode 1A

Using this mode, the DTE encapsulates the DTE service data unit (SDU) into a DXI frame and transmits it to the DCE. This mode operates with AAL 5 only. No AAL 5 functions are performed by the DTE; the DCE performs the AAL 5 and ATM layer functions.

Mode 1B

This mode serves the same purpose as Mode 1A, but it offers additional support for AAL 3/4 for at least one VPI/VCI.

Mode 2

This mode allows the DTE to perform the AAL 3/4 CPCS encapsulation for the DTE SDU, then puts this PDU into an ATM DXI frame. The DSU/CSU then modifies the frame to support either AAL 3/4 or AAL 5.

The DSU/CSU performs AAL functions based on whether the virtual channel connection is set for AAL 3/4 or AAL 5.

In addition to the three modes described by the ATM Forum, our implementation of the ATM DXI specification defines a fourth mode of operation: *Mode 2 Proprietary.*

Mode 2 Proprietary

This mode is a proprietary version of Mode 2 used prior to the development of ATM Forum's standard Mode 2. This version of Mode 2 has some DXI header differences from the standard Mode 2 and it handles only AAL 3/4.

Note: *Use this mode if your configuration uses pre-ATM Forum DXI DSU/CSU devices (for example, a Digital Link DL3200).*

Figure 2-3 illustrates how each mode handles data transfer from the router to the DSU/CSU.

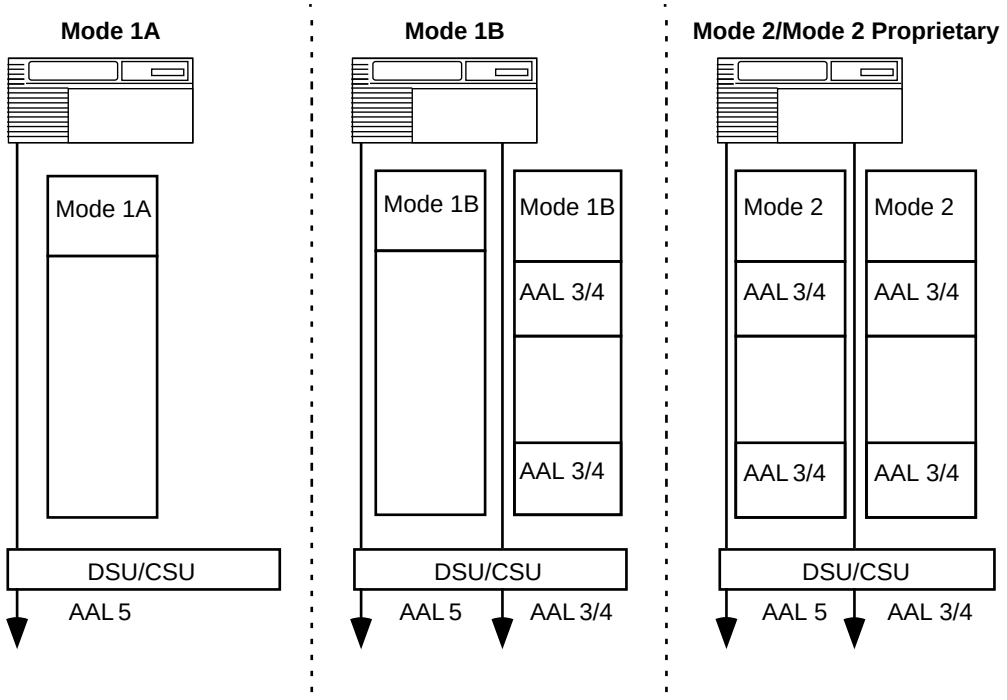


Figure 2-3. DXI Modes of Operation

To select a mode for your router, configure the DXI Mode parameter (refer to "ATM Interface Parameter Descriptions" in Chapter 4 for details).

Access Modes for ATM DXI Services

You can enable each ATM PVC to function in one of three access modes: *group access*, *direct access*, or *hybrid access*. Within the same ATM physical interface you can configure PVCs to use different modes. The following sections describe the access modes.

Group Access Mode

In group access mode, upper-layer protocols treat each ATM network interface as a single access point to the switched network. They use a single network address to send all traffic destined for the switched network to the ATM network interface. Figure 2-4 shows a conceptual drawing of group access mode (the default).

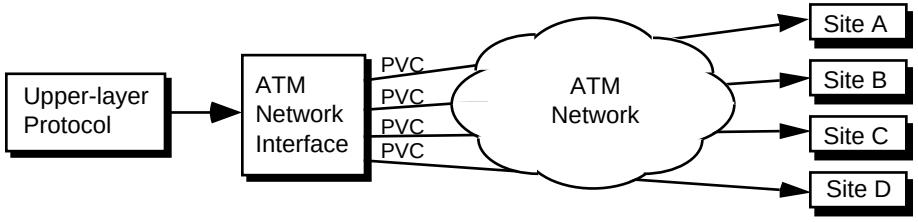


Figure 2-4. Group Access Mode

Group access supports the following protocols: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and transparent bridging. Of the three modes, group access uses network addressing most efficiently and is the easiest to configure. Although you need to configure each PVC manually for group access mode, you need only define and associate protocols with the ATM network interface. All the group access mode PVCs that you configure for a given ATM interface carry the protocols that you select and configure to run on that interface.

Note: *When you configure group access mode, the PVCs all use the AAL type that you set for the ATM DXI interface (that is, the value of the CS PDU Encapsulation parameter set in the ATM DXI Interface List window).*

In a bridged environment, use group access only for fully meshed configurations, or in hub/spoke environments in which the spokes need not communicate. In a nonbridged environment, you can use group access in any configuration that does not require protocols residing on separate PVCs (that is, where all PVCs accept the same protocols).

Group access works best in either fully meshed environments or in nonmeshed environments where systems not directly connected to each other have no need to communicate. There are, however, ways to configure upper-layer protocols, like IP or IPX, to allow systems in nonmeshed networks to fully communicate. Refer to the appropriate upper-layer protocol documentation for more information.

Direct Access Mode

In direct access mode, upper-layer protocols treat the ATM network as a series of point-to-point connections (Figure 2-5). The upper-layer protocols view each PVC as an individual network interface. You can, therefore, configure each direct mode PVC individually. This is helpful if you have different network sites using different types of data encapsulation.

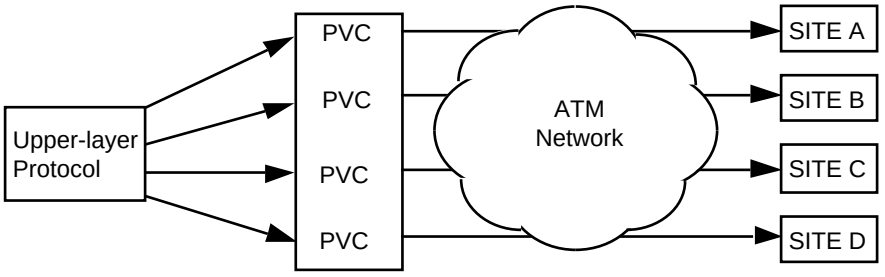


Figure 2-5. Direct Access Mode

Direct access supports the following protocols: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridging. If you use direct access mode, you must configure each PVC manually and assign protocols to run on each PVC. This mode allows you to dedicate a PVC to a particular protocol, but at the expense of some configuration overhead, memory, and address space.

Direct access mode is best suited to small, nonmeshed configurations, or to configurations in which protocols must reside on separate PVCs.

Note: *Be aware that the maximum number of PVCs you can configure in direct access mode varies, depending on the configuration of the router, the number of protocols running on the circuits, and the number of routing entries.*

Hybrid Access Mode

Hybrid access mode combines characteristics of group and direct access modes. It works best for nonmeshed network configurations that use both bridging and routing over a single ATM DXI interface. This mode is also best for spanning tree bridging.

If your network combines bridging and routing over the same interface, you need PVCs in group access mode for routing, while at the same time you need bridging to operate over these same PVCs. Since group access mode does not allow for bridging in nonmeshed environments, you must use hybrid access mode. In this mode, a PVC behaves like a direct access PVC for bridging while maintaining group access characteristics for routing protocols (Figure 2-6).

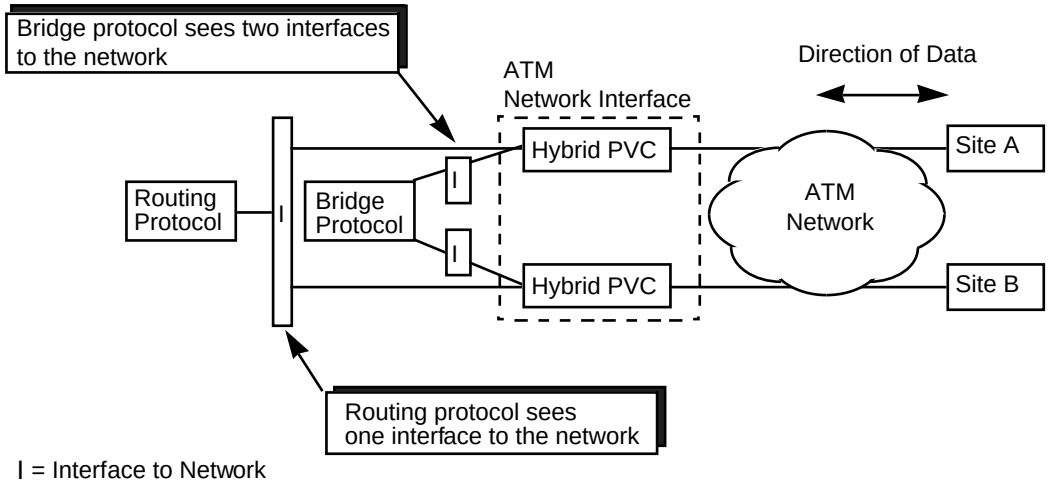


Figure 2-6. Hybrid Access Mode

For hybrid access mode, you must configure all PVCs manually and assign bridging protocols to run on each PVC. Hybrid access supports all protocols that are available for the ATM interface: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridge.

Note: *When you select hybrid access mode for a PVC, Site Manager provides only three protocol options: Bridge, Spanning Tree, and Native Mode LAN (NML). These protocols, as well as the protocols that are on the ATM interface, can run on the PVC.*

Before you configure hybrid access on your router, carefully evaluate the types of routers you are connecting in your network. For example, combining Series 7 routers running in group access bridge mode with Series 7 or higher routers running in hybrid access mode may cause broadcasting or spanning tree problems. If you plan to configure such a network, contact the Bay Networks Technical Response Center.

Using Hybrid Access for Transparent Bridging

In Figure 2-7, traffic bridges between Site A and Site B. The bridge (Router 1) runs on the ATM DXI network interface, and its configuration has the PVCs defined for group access mode.

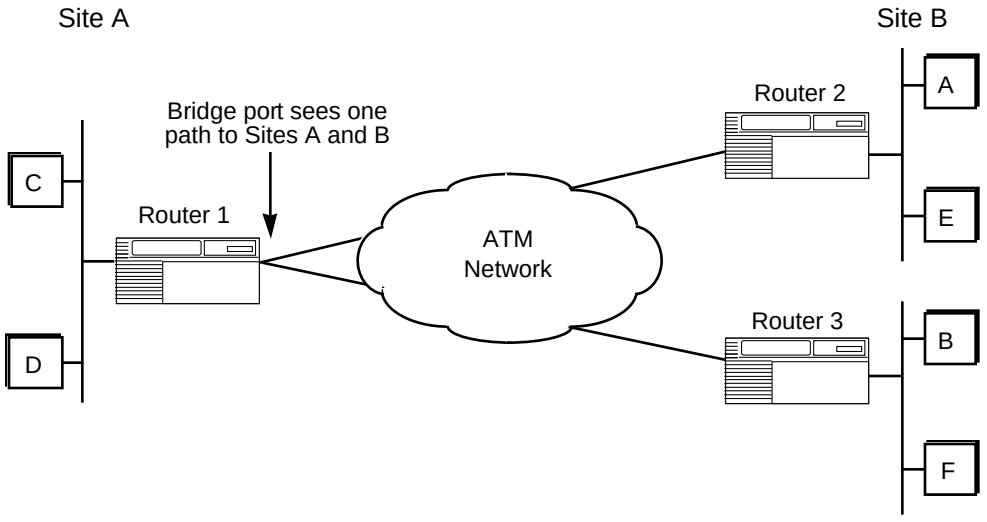


Figure 2-7. Example of a Bridged Network

In Figure 2-7, the bridge receives data from Site A. If the bridge does not recognize the destination address, it tries to direct traffic through another bridge port. However, with group access mode configured, the ATM bridge port views the paths to Site A and Site B as the same path. Because the bridge does not send out data on the same bridge port from which it just received it, the bridge does not direct the data to Site B. In this example, you need to use hybrid access mode.

If you define the PVCs in hybrid access mode, as shown in Figure 2-6, each PVC acts as a bridge port. This enables the bridge running on the ATM interface to view the traffic from Site A as arriving on a different port than that of Site B. When the bridge sends out data, it now has access to all of its ports, including the port that accesses Site B. Therefore, data from Site A can reach Site B.

Using Hybrid Access for Routing

In hybrid access mode, routing protocols view the ATM network interface in terms of group access PVCs, as described in the “Group Access” section, earlier in this chapter.

Multipath Support

Our implementation of ATM DXI provides a redundancy multipath feature. This means, for example, that if there are two physical lines and one line fails, the other takes over the task of transmission (redundancy). If both lines are working, the router uses both lines simultaneously (multipath).

The multipath feature lets you group several lines that back up one another to ensure that information makes it across the network. Figure 2-8 shows a network with two physical links across the ATM network.

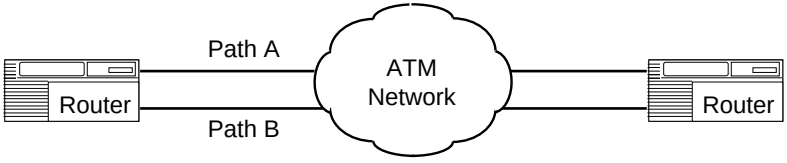


Figure 2-8. Multipath Network

In this example, when the router receives traffic destined for the network, it alternately chooses Path A or Path B, at random, to transmit the data. The router uses both lines, simultaneously, to balance the load. If one of these connections fails, the router uses the remaining path.

You can configure multipath for direct access mode PVCs only. The most significant part of configuring multipath is how you set a PVC's VPI/VCI pair. This number identifies each PVC, thereby identifying a path for the router to direct data out to the network.

See "Setting PVCs for Multipath Mode," in Chapter 4, for instructions on configuring multiple PVCs to run in multipath mode.

Note: *If you use multipath mode, packets traveling on the two paths may arrive at their destination out of sequence. Some protocols do not tolerate packets arriving out of sequence. As a result, you may experience poor performance or failures.*

Chapter 3
Enabling ATM DXI Service

Before you can enable ATM DXI service you must

1. Open a configuration file.
2. Specify router hardware (if using a local mode configuration file).
3. Select the link or net module interface on which you are enabling ATM DXI.

If you have questions about how to perform any of these preliminary tasks, refer to *Configuring Routers*.

For each ATM DXI parameter, this chapters provides information about default settings, valid parameter options, the parameter function, instructions for setting the parameter, and the Management Information Base (MIB) object ID.

The Technician Interface allows you to modify parameters by issuing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager.

For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

Caution: *The Technician Interface does not verify that the value you enter for a parameter is valid. Entering an invalid value can corrupt your configuration.*

Enabling Overview

When you enable ATM DXI service, you must

1. Enable ATM DXI on an interface.
2. Enable protocols on that interface.
3. Add permanent virtual circuits (PVCs).

If you want to edit the ATM DXI Interface parameters, which define the ATM interface to the physical line, or add more PVCs, refer to Chapter 4.

Enabling ATM DXI on an Interface

To enable ATM DXI on an interface, complete the following steps:

1. **Select ATM DXI from the WAN Protocols window (Figure 3-1); this window opens after you select a link or net module connector that requires a WAN protocol.**

Figure 3-1. WAN Protocols Window

2. **Click on OK.**

   The Select Protocols window opens (Figure 3-2).

Figure 3-2. Select Protocols Window

The next section explains how to enable protocols.

Enabling Protocols on an ATM DXI Circuit

To enable protocols on the ATM DXI circuit:

1. **Select the protocols you want to enable on this circuit from the Select Protocols window (refer to Figure 3-2).**
2. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, Site Manager displays the Configuration Manager window.

Adding PVCs

To add a PVC, complete the following steps:

1. **From the Configuration Manager window, select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (Figure 3-3).

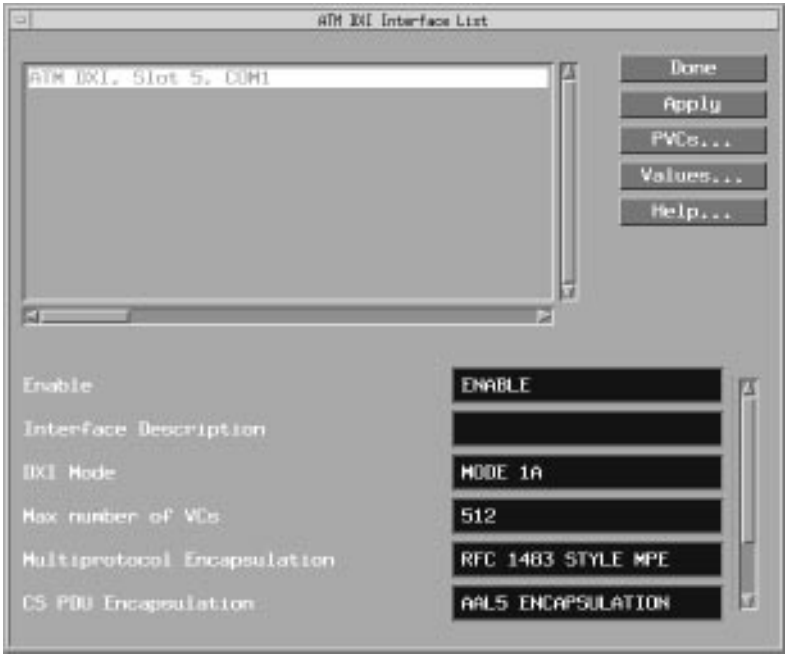


Figure 3-3. ATM DXI Interface List Window

2. **Select the ATM DXI interface to which you want to add PVCs and click on the PVCs button.**

   The ATM DXI PVC List window opens (Figure 3-4).

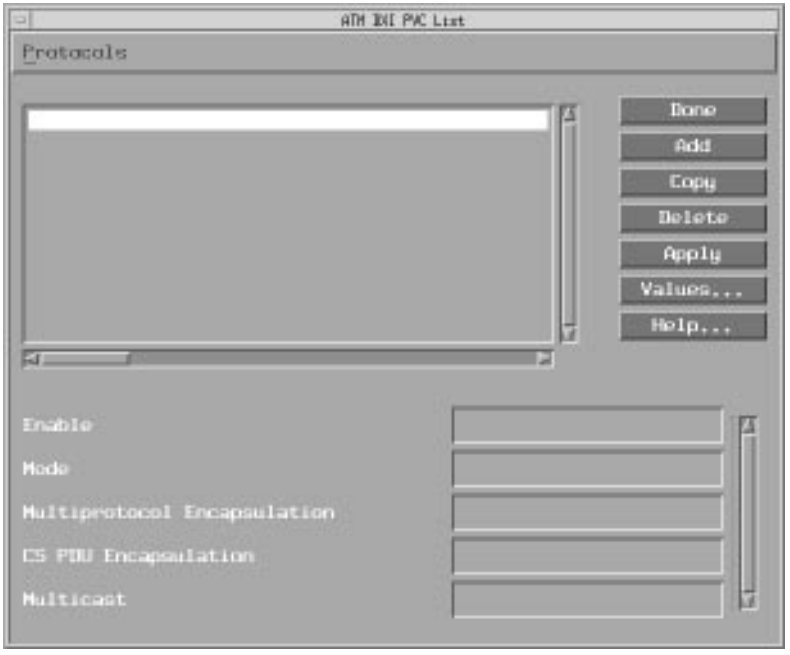


Figure 3-4. ATM DXI PVC List Window

3. Click on Add.

The ATM DXI Virtual Circuit window opens (Figure 3-5).

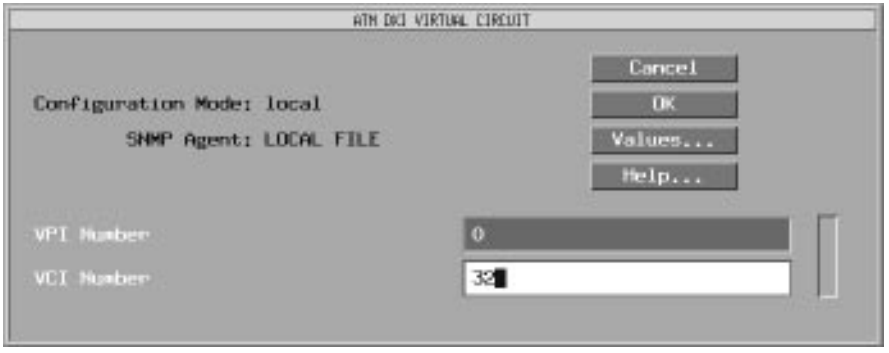


Figure 3-5. ATM DXI Virtual Circuit Window

4. **Enter the VPI and VCI numbers that you want to use for the PVC.**

   These parameters vary depending on how you set the DXI Mode parameter in the ATM DXI Interface List window (Figure 3-3). Refer to the next section for guidelines.

5. **Click on OK.**

   Site Manager returns you to the ATM DXI PVC List window (refer to Figure 3-4). The default mode of the PVC you just added is GROUP ACCESS. If you want to change any of the parameters on the ATM DXI PVC List window, refer to Chapter 4 for instructions.

Note: *To add another PVC with the default configuration, repeat Steps 3, 4, and 5. When you finish adding PVCs, go to Step 6.*

6. **Click on Done.**

   Site Manager returns you to the ATM DXI Interface List window.

7. **Click on Done.**

   Site Manager returns you to the Configuration Manager window.

ATM DXI Virtual Circuit Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters in the ATM DXI Virtual Circuit window.

Note: *ATM DXI does not allow duplicate VPI/VCI pairs on the same ATM physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, on different link modules).*

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the PVC.
Instructions:	How you set this parameter depends on how you set the DXI Mode parameter in the ATM DXI Interface List window (refer to Figure 3-3). If you select Mode 1A (default) or 1B for the DXI Mode value, enter a value between 0 and 15. If you select Mode 2 or Mode 2 Proprietary, enter a value between 0 and 255. Refer to Chapter 4 for more information.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.3

Parameter:	**VCI Number**
Default:	None
Range:	32 to 65535
Function:	Identifies the virtual channel of the PVC.
Instructions:	How you set this parameter depends on how you set the DXI Mode parameter in the ATM DXI Interface List window (refer to Figure 3-3). If you select Mode 1A (default) or 1B for the DXI Mode value, enter a value between 32 and 63. If you select Mode 2 or Mode 2 Proprietary, enter a value between 32 and 65535. Refer to Chapter 4 for more information.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.4

Chapter 4
Editing ATM DXI Parameters

Once you configure a circuit to support ATM DXI, you can use the Configuration Manager to edit ATM DXI parameters.

Note: *You must first configure ATM DXI on the router before you can edit ATM DXI parameters. For instructions on how to configure ATM DXI, or how to add additional ATM DXI interfaces, refer to Chapter 3.*

For each ATM DXI parameter, this chapter describes

- The default setting
- All valid setting options
- The parameter function
- Instructions for setting the parameter

Begin from the Configuration Manager window (Figure 4-1), the first window that appears when you enter the Configuration Manager tool.

Figure 4-1. Configuration Manager Window

Editing ATM DXI Interface Parameters

The ATM DXI Interface parameters define the ATM DXI interface to the physical line. You edit the parameters from the ATM DXI Interface List window (Figure 4-2). To access this window, use the following procedure:

1. **Select Protocols→ATM DXI→Interfaces from the Configuration Manager window.**

   Site Manager displays the ATM DXI Interface List window (Figure 4-2).

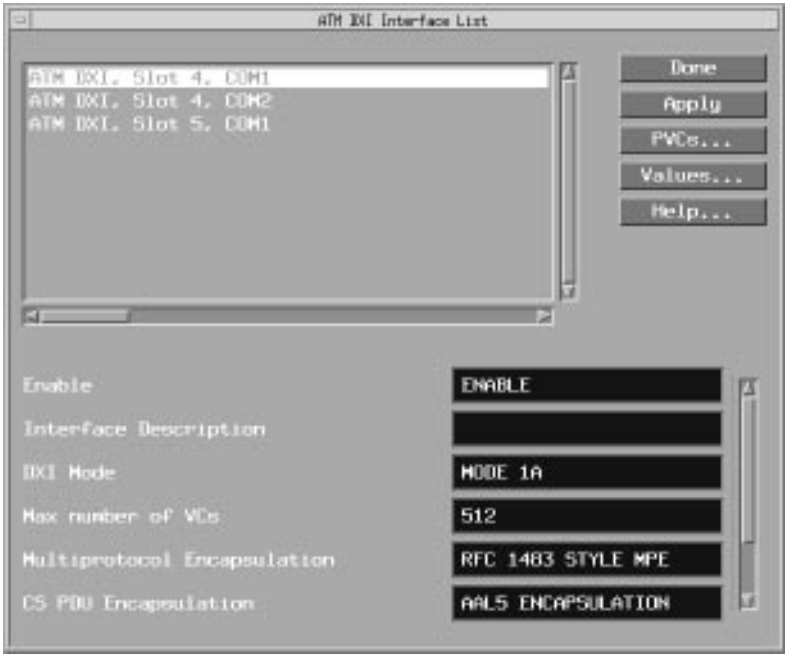


Figure 4-2. ATM DXI Interface List Window

2. **From the ATM DXI Interface List window, select the interface you want to edit.**
3. **Configure the parameters on the screen (refer to the descriptions following this procedure for guidelines).**
4. **When you finish editing the parameters, click on Apply.**
5. **To add PVCs to the interface, click on PVCs. Refer to "Configuring PVCs," later in this chapter.**

Note: *To edit any additional interfaces, repeat Steps 2 through 5.*

6. **When you finish editing all interfaces, click on Done.**

   Site Manager returns you to the Configuration Manager window.

ATM DXI Interface Parameter Descriptions

Use the following guidelines to set the parameters in the ATM DXI Interface List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables ATM DXI on the selected interface.
Instructions:	Set to Disable if you want to disable ATM DXI for the selected interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.2

Parameter:	**Interface Description**
Default:	None
Range:	1 to 63 alphanumeric characters
Function:	Describes the selected ATM interface.
Instructions:	Enter text to describe the destination or the purpose of the interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.7

Parameter:	**DXI Mode**
Default:	Mode 1A
Options:	Mode 1A | Mode 1B | Mode 2 | Mode 2 Proprietary
Function:	Identifies the ATM DXI mode of operation for this interface, based on the ATM Forum's ATM DXI specification. Each mode relates to a different set of operations and functionality between the router and DSU/CSU.
Instructions:	Enter the desired mode of operation. Refer to "ATM DXI Modes of Operation" in Chapter 2 for a detailed description of each mode. The DXI header size is different for Modes 1A and 1B than for Mode 2 and Mode 2 Proprietary. This difference affects the value that you set for the VPI and VCI parameters. For allowable VPI and VCI entries for each mode, refer to "ATM DXI Virtual Circuit Parameter Descriptions" later in this chapter.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.18

Parameter:	**Max number of VCs**
Default:	512
Range:	1 to 512
Function:	Specifies the maximum number of virtual channels (VCs) allowed on the selected interface. This value is for PVCs only.
Instructions:	Accept the default, 512, or enter a different value between 1 and 512, inclusive.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.5

Parameter:	**Multiprotocol Encapsulation**
Default:	RFC 1483 Style MPE
Options:	RFC 1483 Style MPE | RFC 1294 Style MPE | No MPE
Function:	Determines whether the outbound packets on the selected interface are encapsulated with a multiprotocol header per RFC 1294 or RFC 1483. All group or hybrid access mode PVCs configured for the selected interface use the value you set for this field.
Instructions:	We recommend selecting RFC 1483 Style MPE. If you are running a version of the ATM DXI lower than Version 8.00, select RFC 1294 Style for backward compatibility. If you select No MPE, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.11

Parameter:	**CS PDU Encapsulation**
Default:	AAL5 Encapsulation
Options:	AAL5 Encapsulation | AAL3/4 Encapsulation | No Encapsulation
Function:	Determines whether the outbound packets on the grouped virtual channels use the AAL 3/4 CS_PDU encapsulation or the AAL 5 CS_PDU encapsulation. The encapsulating method is based on the ATM Forum's ATM DXI specification. All group and hybrid access mode PVCs configured for the selected interface use the value you set for this field.
Instructions:	Choose either AAL 3/4 or AAL 5 according to the desired encapsulation method. No Encapsulation is a proprietary value. Select this value when you do not want CS_PDU encapsulation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.12

Parameter:	**Multicast**
Default:	Disable
Options:	Enable | Disable
Function:	Indicates whether the selected ATM DXI interface supports multicast packets.
Instructions:	Accept the default, Disable, if you do not want the interface to accept multicast packets. Set to Enable if you want the selected interface to accept multicast packets.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.13

Parameter:	**LMI Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies whether our proprietary version of the Local Management Interface (LMI) is enabled for the selected interface. This LMI is not compatible with the ATM Forum standard LMI, and is only for use with DXI Mode 2 Proprietary.
Instructions:	Accept the default, Enable, if you want LMI enabled for the interface. Set to Disable if you do not want LMI available for the interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.15

Caution: *If you disable LMI, the DSU/CSU cannot report traps to the router and the router cannot retrieve statistical information from the DSU/CSU.*

Configuring PVCs

You must manually configure all ATM PVCs for each interface. This section describes how to

- Add or copy PVCs
- Edit PVC configuration parameters

Adding or Copying PVCs

Whether you add or copy a permanent virtual circuit, you can always change the configuration of the PVC later.

Caution: *When you run PVCs in direct or hybrid access mode, the copy function copies all of the existing PVC-specific information to the new PVC. However, this function does not copy the protocols that you have selected and configured for that PVC. You must select and configure any desired protocols for the newly copied PVC.*

To add a PVC, complete the following steps:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (refer to Figure 4-2).

2. **Click on PVCs.**

   The ATM DXI PVC List window opens (Figure 4-3).

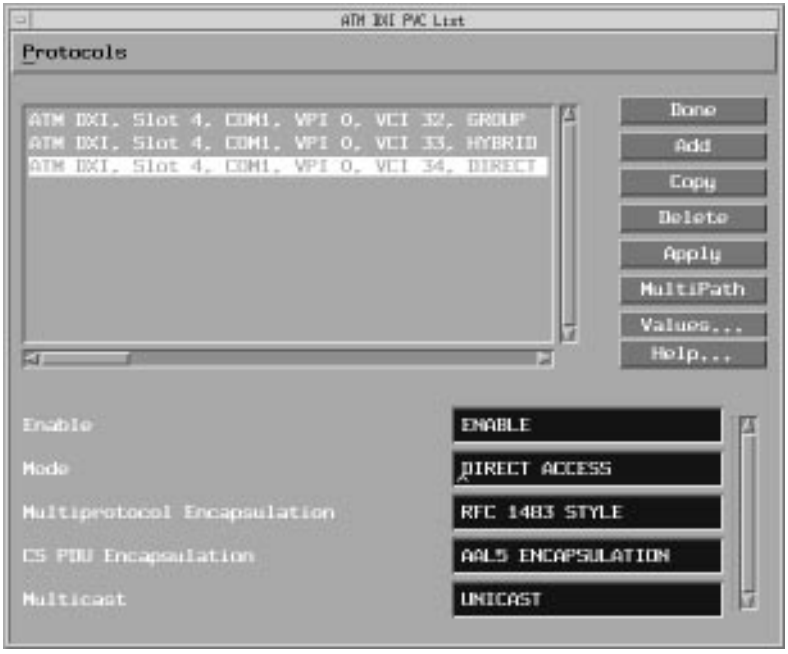


Figure 4-3. ATM DXI PVC List Window

3. Click on Add.

The ATM DXI Virtual Circuit window opens (Figure 4-4).

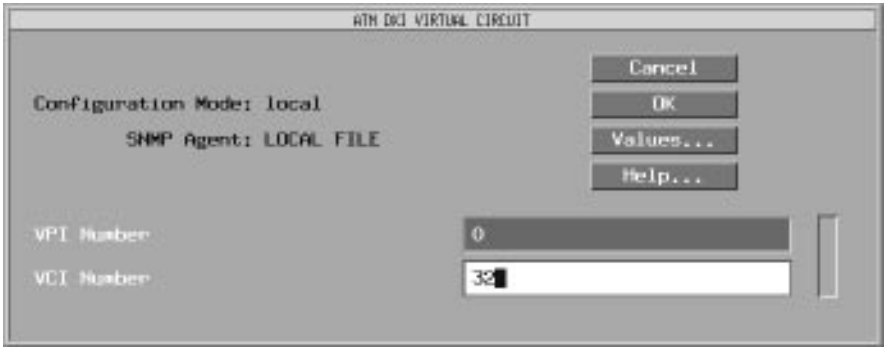


Figure 4-4. ATM DXI Virtual Circuit Window

4. **Enter the VPI and VCI numbers that you want to use for the PVC. Refer to the following section for guidelines.**
5. **Click on OK.**

   Site Manager returns you to the ATM DXI PVC List window (refer to Figure 4-3). The window displays the default parameter values for this PVC.
6. **If you want to change the default configuration of the PVC, go to "Editing PVC Configuration Parameters," later in this chapter.**

To copy an existing PVC, complete the following steps:

Note: *If you have just completed the procedure to add a PVC, skip to Step 3.*

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (refer to Figure 4-2).
2. **Click on PVCs.**

   The ATM DXI PVC List window opens (refer to Figure 4-3).
3. **Select the PVC that you want to copy.**
4. **Click on Copy.**

   The ATM DXI Virtual Circuit window opens (refer to Figure 4-4).
5. **Enter the VPI and VCI numbers that you want to use for the PVC. Refer to the following section for guidelines.**
6. **Click on OK.**

   Site Manager returns you to the ATM DXI PVC List window (refer to Figure 4-3).

Caution: *When you run PVCs in direct or hybrid access mode, the copy function copies all of the existing PVC-specific information to the new PVC. However, this function does not copy the protocols that you have selected and configured for that PVC. You must select and configure any desired protocols for the newly copied PVC.*

7. **If you want to edit the default configuration of the PVC, go to "Editing PVC Configuration Parameters," later in this chapter.**

ATM DXI Virtual Circuit Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters in the ATM DXI Virtual Circuit window.

Note: *ATM DXI does not allow duplicate VPI/VCI pairs on the same ATM physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, on different link modules).*

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the PVC.
Instructions:	If you select Mode 1A or 1B for the DXI Mode value, enter a value from 0 to 15. If you select Mode 2 or Mode 2 Proprietary, enter a value from 0 to 255.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.3

Parameter:	**VCI Number**
Default:	None
Range:	32 to 65535
Function:	Identifies the virtual channel of the PVC.
Instructions:	If you select Mode 1A or 1B for the DXI Mode value, enter a value from 32 to 63. If you select Mode 2 or Mode 2 Proprietary, enter a value from 32 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.4

Editing PVC Configuration Parameters

To edit PVC configuration parameters, complete the following procedure:

Note: *If you have just completed the procedure to add or copy a PVC, skip to Step 4.*

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM Interface List window opens (refer to Figure 4-2).

2. **Select the ATM DXI interface that contains the desired PVC.**
3. **Click on PVCs.**

   The ATM DXI PVC List window opens (refer to Figure 4-3).

4. **Select the PVC you want to configure.**
5. **Assign values to the configuration parameters. Refer to "ATM DXI PVC List Parameter Descriptions" for guidelines.**
6. **Click on Apply.**

   Site Manager saves your changes. If you configure the PVC to run in direct or hybrid access mode, the Configuration Manager adds a Protocols menu option in the top left corner of the ATM DXI PVC List window. The Configuration Manager then displays a Select Protocols window (Figure 4-5).

Note: *If you configure the PVC to operate in hybrid mode, only Bridge, Spanning Tree, and Native Mode LAN appear as options in the Select Protocols window. We strongly recommend that you enable spanning tree on all hybrid access PVCs to detect loops in the network.*

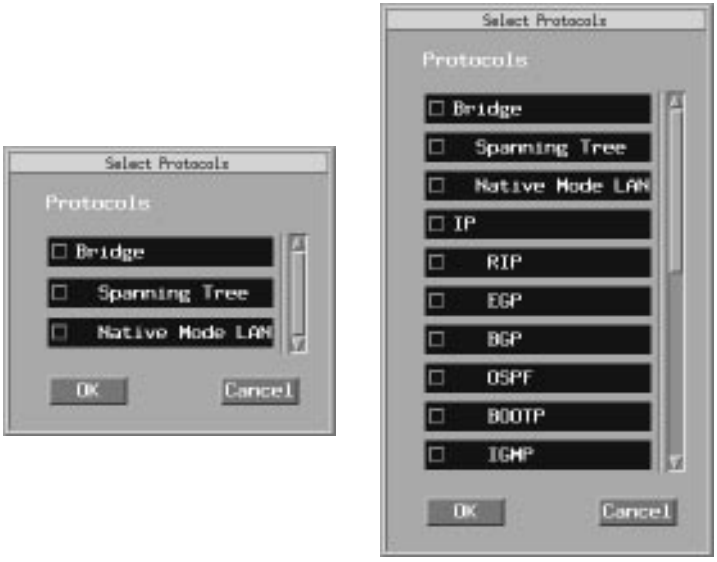


Figure 4-5. Select Protocols Window (Hybrid and Direct Access)

7. **Select the protocols you want this PVC to carry, and click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring protocols, the Configuration Manager returns you to the ATM DXI PVC List window (refer to Figure 4-3).

Note: *If you select the bridge protocol for a hybrid or direct mode PVC, the Configuration Manager automatically sets the Multiprotocol Encapsulation parameter to Enable.*

ATM DXI PVC List Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters in the ATM DXI PVC List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies whether this PVC is enabled for the selected interface.
Instructions:	Set to Disable if you do not want this PVC enabled.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.14

Parameter:	**Mode**
Default:	Group Access
Options:	Group Access | Hybrid Access | Direct Access
Function:	Specifies the role of the PVC.
Instructions:	Accept the default, group access, if you want the PVC to be part of a group of PVCs. Set to hybrid access if you want the PVC to be part of a group of PVCs for routing, and to direct access for bridging. Set to direct access if you want the PVC to be used for bridging or routing to different networks. For more information about the three modes, refer to "Access Modes for ATM DXI Services" in Chapter 2.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.9

Parameter:	**Multiprotocol Encapsulation**
Default:	RFC 1483 Style
Options:	RFC 1483 Style | RFC 1294 Style | No MPE
Function:	Determines whether the outbound packets on the selected interface are encapsulated with a multiprotocol header per RFC 1294 or RFC 1483. All direct access mode PVCs configured for the selected interface use the value of this field.
Instructions:	We recommend selecting RFC 1483 Style. If you are running an ATM DXI version lower than Version 8.00, select RFC 1294 Style for backward compatibility. If you select No MPE, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.12

Parameter:	**CS PDU Encapsulation**
Default:	AAL5 Encapsulation
Options:	AAL5 Encapsulation | AAL3/4 Encapsulation | No Encapsulation
Function:	Determines whether the outbound packets on the grouped virtual channels use the AAL 3/4 CS PDU encapsulation or the AAL 5 CS PDU encapsulation. The encapsulating method is based on the ATM Forum's ATM DXI specification.
Instructions:	Choose either AAL 3/4 or AAL 5 according to the desired encapsulation method. No Encapsulation is a proprietary value. Select this value when you do not want CS PDU encapsulation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.13

Parameter:	**Multicast**
Default:	Unicast
Options:	Unicast | Multicast
Function:	Indicates whether this PVC is multicast or unicast.
Instructions:	Set to unicast or multicast, according to the PVC type.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.16

Enabling and Editing Protocols for Group Access PVCs

After you add at least one PVC that functions in group access mode (the default), you can enable and edit bridging/routing protocols for that PVC.

To enable or disable a protocol on a group access circuit, use the following procedure:

1. **From the Configuration Manager window (refer to Figure 4-1), click on the ATM circuit to which you want to add bridging/routing protocols.**

   The Edit Connector window opens (Figure 4-6).

Figure 4-6. Edit Connector Window

2. **Click on Edit Circuit**

   The Circuit Definition window opens (Figure 4-7).

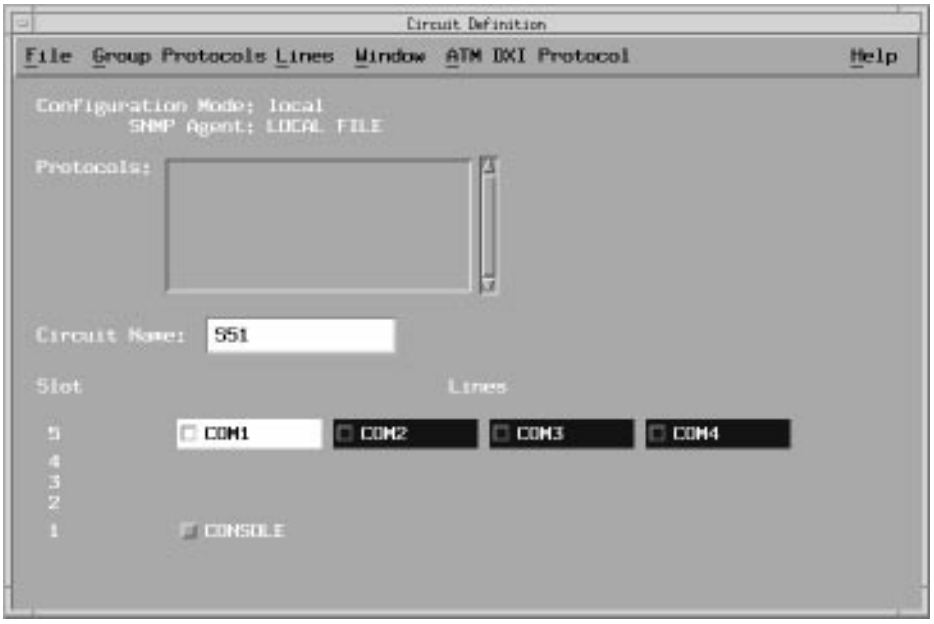


Figure 4-7. Circuit Definition Window

3. **Select Group Protocols→Add/Delete.**

   The Select Protocols window opens (Figure 4-8).

Figure 4-8. Select Protocols Window (Group Access)

4. **Select the bridging/routing protocols you want to enable on that circuit and click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns you to the Circuit Definition window.

   For each protocol you deselect, the Configuration Manager removes that protocol from the circuit.

To edit a protocol on a group access circuit, use the following procedure:

1. **From the Configuration Manager window (refer to Figure 4-1), click on the ATM circuit to which you want to add bridging/routing protocols.**

   The Edit Connector window opens (refer to Figure 4-6).

2. **Click on Edit Circuit.**

   The Circuit Definition window opens (refer to Figure 4-7).

3. **Click on Group Protocols.**

   The menu displays a list of the existing protocols on that PVC (Figure 4-9).

Figure 4-9. Group Protocols Menu (Top Level)

4. **Select the protocol whose parameters you want to edit.**

   The Configuration Manager displays the requested protocol-specific window. If you need assistance in editing a specific protocol, consult the appropriate protocol-specific guide.

Note: *Site Manager provides a menu structure for some protocols to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses spanning tree, you can bypass the upper-level bridging parameters and edit the spanning tree parameters directly (Figure 4-10).*

Figure 4-10. Group Protocols Menu (Various Levels)

Enabling and Editing Protocols for Direct or Hybrid Access PVCs

After you configure a PVC to operate in hybrid or direct access mode, you can enable or edit protocols for that PVC.

To enable or disable a protocol on an existing PVC, use the following procedure:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (refer to Figure 4-2).

2. **Click on PVCs.**

   The ATM DXI PVC List window opens (refer to Figure 4-3).

3. **Select the hybrid or direct access PVC you want to configure.**

4. **Select Protocols→Add/Delete.**

   The Select Protocols window opens (Figure 4-11).

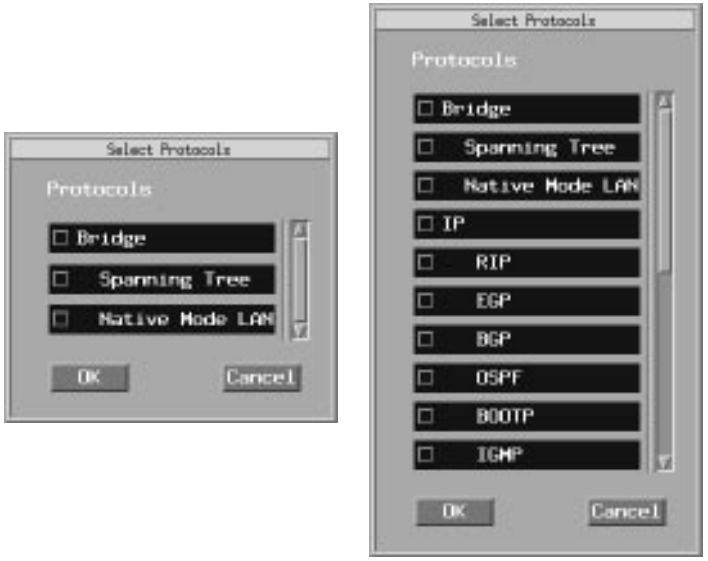


Figure 4-11. Select Protocols Window (Hybrid and Direct Access)

5. **Select the bridging/routing protocol that you want to enable or disable for that circuit and click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns you to the ATM DXI PVC List window.

   For each protocol you deselect, the Configuration Manager removes that protocol from the PVC.

To edit an existing protocol, use the following procedure:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (Figure 4-2).

2. **Click on PVCs.**

   The ATM DXI PVC List window opens (Figure 4-3).

3. **Select the hybrid or direct PVC you want to configure.**

4. **Click on the Protocols menu option.**

   The menu displays a list of the existing protocols on that PVC (Figure 4-12).

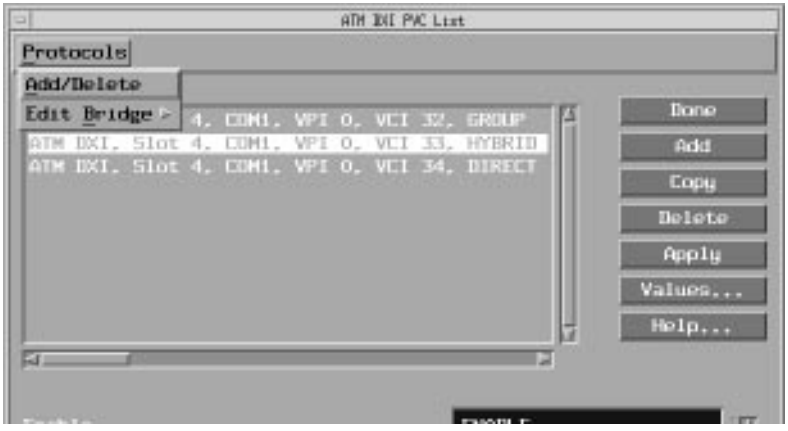


Figure 4-12. Protocols Menu (Top Level)

5. **Select the protocol that you want to edit.**

   The Configuration Manager displays the requested protocol-specific window. If you need assistance in editing a specific protocol, consult the appropriate protocol-specific guide.

Note: *Site Manager provides a menu structure for some protocols to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses Spanning Tree, you can bypass the upper-level bridging parameters and edit the Spanning Tree parameters directly (Figure 4-13).*

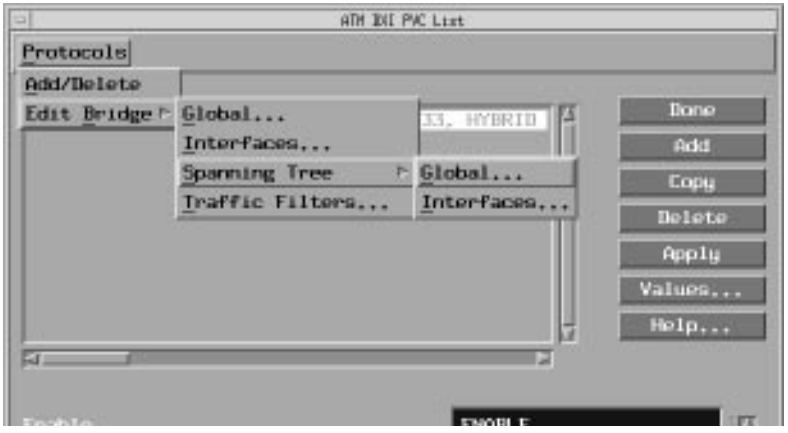


Figure 4-13. Protocols Menu (Multiple Levels)

Setting PVCs for Multipath Mode

You can set two or more PVCs to run in multipath mode, as described in "Multipath Support" in Chapter 2. When setting PVCs for multipath mode, keep the following in mind:

- The PVCs must have the same VCI and VPI numbers.
- You can only set direct access PVCs to operate in multipath mode.

To set PVCs to use multipath mode, complete the following steps:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (refer to Figure 4-2).

2. **Click on PVCs.**

   The ATM DXI PVC List window opens (Figure 4-14).

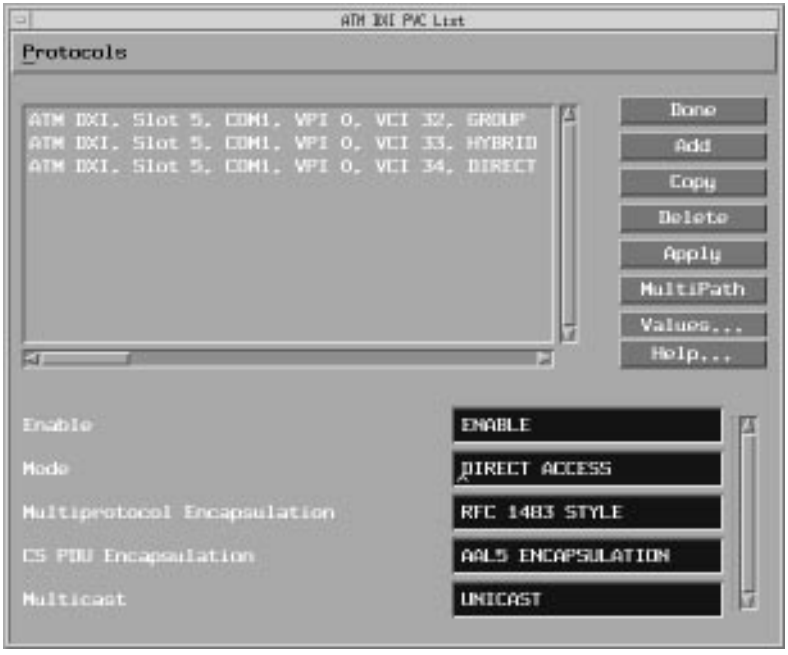


Figure 4-14. Multipath Button

3. **Select the first PVC you want to run in multipath mode.**

4. **Click on Multipath.**

   The Multipath Selection window opens (Figure 4-15). This window shows all PVCs that you can set for multipath mode, along with the PVC you selected.

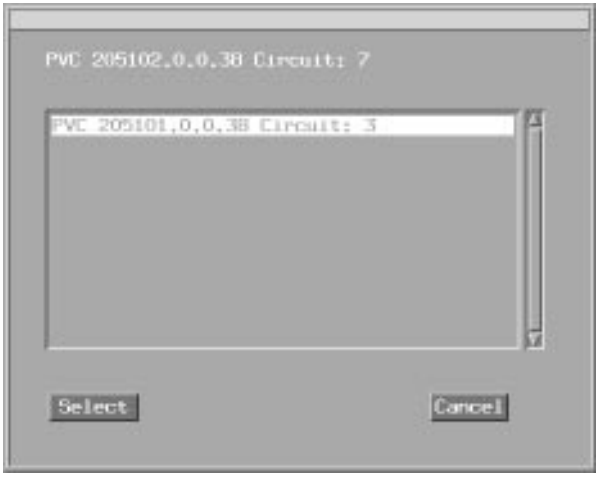


Figure 4-15. Multipath Selection Window

5. **Select a PVC that you want to group with the first PVC.**
6. **Click on Select.**

   The ATM DXI PVC List window opens (refer to Figure 4-14).
7. **Repeat this procedure until you select all of the PVCs that you want to run in multipath mode.**

Deleting PVCs

To delete a PVC, complete the following steps:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Interfaces.**

   The ATM DXI Interface List window opens (refer to Figure 4-2).
2. **Click on PVCs.**

   The ATM DXI PVC List window opens (refer to Figure 4-3).
3. **Select the PVC you want to delete.**

4. **Click on Delete.**

   Site Manager asks you to confirm the deletion.

5. **Click on OK to delete the PVC.**

Deleting ATM DXI from the Router

To delete ATM DXI from all circuits on which it is currently configured, complete the following steps:

1. **From the Configuration Manager window (refer to Figure 4-1), select Protocols→ATM DXI→Delete ATM.**

   Site Manager asks:

   ```
   Do you REALLY want to delete ATM?
   ```

2. **Click on OK.**

   Site Manager returns you to the Configuration Manager window. ATM DXI is no longer operating on the router.

Chapter 5
ATM Features and Implementation Notes

In a Bay Networks router, intelligent link interface (ILI) pairs provide access and processing. An ILI pair consists of a link module and a processor module that work together to process and transmit information over a network. Bay Networks currently provides the following ATM ILI pairs:

- An ATM FRE2 link module in conjunction with a Fast Routing Engine (FRE2) processor
- An ATM Routing Engine link module in conjunction with an ATM Routing Engine (ARE) processor

Either ILI pair allows the router to connect directly to an ATM network over any of these physical interfaces:

- Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH)
- Digital Service level 3 (DS-3)
- E-3 (the European equivalent of the North American DS-3)

This means that both ILI pairs convert variable-length packets into uniform, 53-byte cells for transmission over the ATM network (Figure 5-1).

Both ILI pairs are functionally similar, and you configure them in much the same way. Unless otherwise noted, the remainder of this guide treats both ILI pairs as if they were the same.

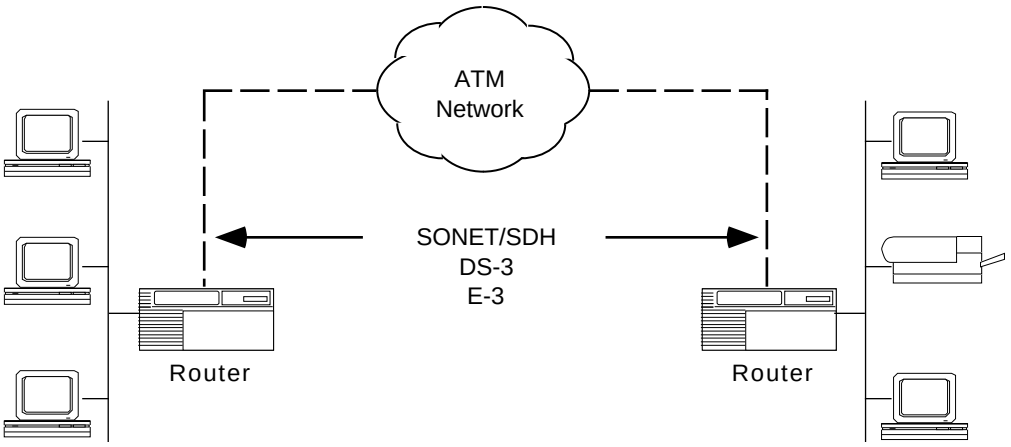


Figure 5-1. ATM Direct Connectivity

Before you customize ATM on your router

- Read about the kinds of support that a router running ATM provides.
- Review the notes describing how Bay Networks implements special ATM features.

ATM Support

A router running ATM provides the following support:

- Bridging and routing protocols, depending on how you define certain parameters (refer to Chapter 6 for a list of protocols)
- MAC-level transparent bridging over the ATM network
- A Convergence Sublayer function compatible with AAL 5, as defined in Section 1 of the CCITT (now ITU-T) *B-ISDN Protocol Reference Model* (PRM)
- Multiprotocol encapsulation functions as defined in RFC 1483 that enable concurrent bridging and multiprotocol routing support on the same VC
- Interim Local Management Interface (ILMI) ATM address registration
- ARP and Inverse ARP support

- Classical IP and ARP over ATM functions as defined in RFC 1577
- LAN emulation (LANE) functions as defined in the ATM Forum *LAN Emulation Over ATM* specification (Version 1.0)

Note: *Bay Networks routers currently provide only Ethernet (IEEE 802.3) emulated LAN connectivity.*

- ATM signaling functions as defined in the ATM Forum *ATM User-Network Interface* specification (Version 3.0)
- Signaling AAL functions as defined in the ATM Forum *ATM User-Network Interface* specification (Version 3.0)
- Error checking
- Broadcasting and simulated multicasting support
- The Segmentation and Reassembly (SAR) sublayer of the AAL
- The ATM layer defined in the B-ISDN reference model

Multiprotocol Encapsulation

Multiprotocol encapsulation enables the router to multiplex (combine) and demultiplex (separate) bridged or routed protocol data units (PDUs).

For transmission, the encapsulation process adds a header between two and eight octets in length to the PDU to allow decoding. The decoding process determines the proper service access point (SAP).

When receiving information, the encapsulation method evaluates the header to determine whether the PDU is a valid routed or bridged cell. If it is valid, the encapsulation method then strips the header from the cell and passes it to the appropriate SAP for routing or bridging.

Depending on the VC type, ATM allows you to use either LLC/SNAP, NULL, or LANE 802.3 encapsulation.

Interim Local Management Interface (ILMI)

In a switched ATM network, an ATM device must register its ATM address with an ATM switch. The router uses ILMI to send and receive initial registration data to and from an ATM switch. Using a series of ILMI SNMP **set** and **get** commands, the router

1. Initializes its ATM address table for the interface (the switch also initializes its address table for the interface).
2. Receives the ATM Address Network Prefix from the switch.
3. Combines this Network Prefix with its own User Part (suffix).
4. Transmits the entire address to the switch.

ARP and Inverse ARP Support

ATM supports address resolution protocol (ARP), enabling the router to dynamically resolve IP network layer protocol-to-VPI/VCI address mappings. ATM learns the address of the virtual circuit by detecting the virtual circuit that delivered the ARP response.

ATM also supports Inverse ARP. However, you can use Inverse ARP only if both the local and remote router support it.\

Bay Networks uses both proprietary and standard ARP and Inverse ARP for PVCs that run IP. Which method the PVC uses depends on how you configure the address resolution parameter for the IP interface. Refer to *Configuring IP Services* for additional information about the IP address resolution parameter.

Bay Networks uses standard ARP and Inverse ARP for SVCs running classical IP (RFC 1577) and SVCs running LAN emulation.

LAN Emulation

Today’s networks consist of a vast amount of existing LAN application software. LAN emulation provides a way to accommodate this software while taking advantage of ATM technology. In other words, LAN emulation allows the router to connect to the ATM network while LAN application software continues to operate as if it were running on a traditional LAN.

For additional information on LAN emulation, refer to Appendix B.

ATM Signaling

ATM signaling allows the router to dynamically establish, maintain, and clear a switched virtual connection at the UNI. Using a series of messages (as defined by the Q.2931 standard for signaling protocol [Figure 5-2]), the router

1. Assesses the availability of an ATM endpoint (device).
2. Establishes a connection with that device.
3. Maintains that connection for the duration of data transfer.
4. Clears the connection when the transfer is complete.

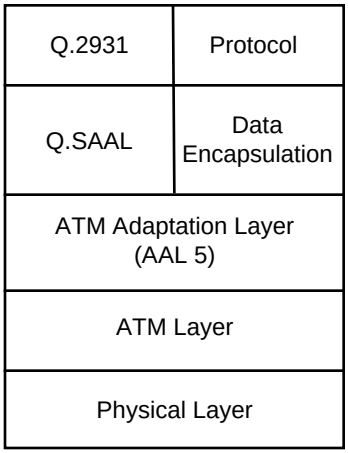


Figure 5-2. SVC/PVC Signaling Protocol Stack

Signaling ATM Adaptation Layer (SAAL)

As defined by the ATM Forum *ATM User-Network Interface Specification* (Version 3.0), the SAAL resides between the ATM layer and the Q.2931 signaling layer. SAAL reliably transports signaling messages between peer Q.2931 entities over the ATM layer (refer to Figure 5-2).

ATM Error Checking

ATM verifies that the VPI/VCI is valid with respect to the PVCs configured for the ATM circuit. It also verifies the header format. ATM verifies valid SVC connection through signaling messages.

Simulated Multicast Packet Support

Simulated multicasting is generally used in certain address resolution techniques and for applications that require the delivery of identical information to multiple recipients. Bay Networks ATM routers simulate multicasting by sending a copy of the multicast or broadcast packet to every available virtual circuit on a particular logical interface.

ATM Implementation Notes

This section describes special features regarding how we implement ATM.

Service Records and Virtual Circuits

ATM devices communicate using virtual circuits. These virtual circuits transmit and receive ATM cells containing upper-layer protocols. Service records provide a way of creating logical interfaces (within the physical ATM interface) for these upper-layer protocols. In essence, these service records allow you to

- Organize multiple VCs into logical groups
- Create direct, point-to-point connections
- Assign, delete, and modify upper-layer protocols for just one PVC, or for a group of VCs, at any given time

PVC Access Methods

You can set up PVCs to access an ATM network in the following ways:

- Multiple PVCs per service record
- One PVC per service record
- Hybrid access PVCs

The following sections describe each form of access.

Multiple PVCs

Upper-layer protocols treat each service record on an ATM network interface as a single access point. These protocols use a single network address to send all traffic destined for the network to the ATM network interface. Figure 5-3 shows a conceptual drawing of multiple PVCs accessing an ATM network through one service record.

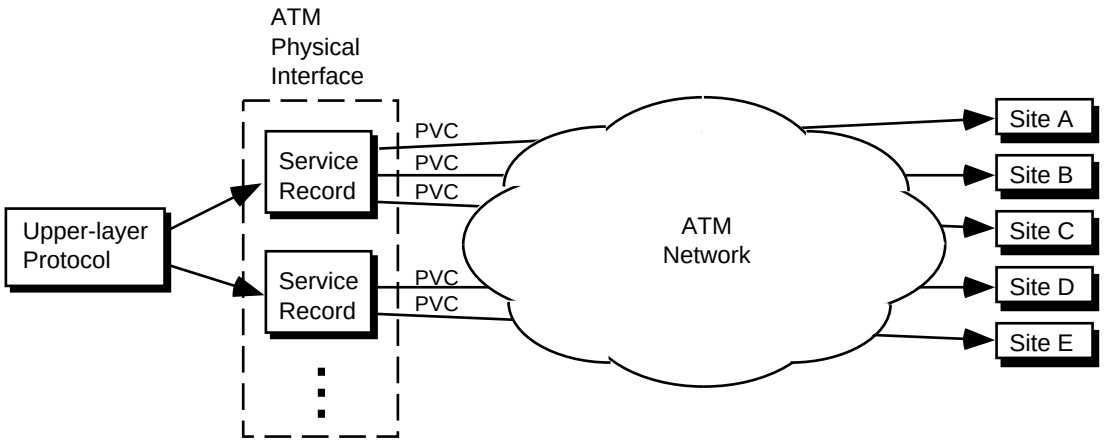


Figure 5-3. Multiple PVCs per Service Record

Of the different methods, having multiple PVCs per service record uses network addressing most efficiently, and is the easiest to configure.

Although you need to configure each PVC manually, you need only define and associate protocols with the ATM network service record. All the PVCs that you configure for a given ATM service record carry the protocols that you select and configure to run on that service record.

Note: *When you configure multiple PVCs per service record, the PVCs all use the data encapsulation type that you set for the ATM service record (that is, the value of the Data Encapsulation Type parameter set in the ATM Service Records List window). Refer to "Assigning Data Encapsulation" in Chapter 7.*

Multiple PVCs per service record works best in either fully meshed environments or in nonmeshed environments where systems not directly connected to each other have no need to communicate. You can configure multiple PVCs per service record as long as you do not need to separate protocols by PVC (that is, all PVCs accept the same protocols).

There are, however, ways to configure upper-layer protocols, such as IP or IPX, to allow systems in nonmeshed networks to fully communicate. See the appropriate documentation for these upper-layer protocols for more information.

One PVC

One PVC per service record works the same way as multiple PVCs per service record, except that you assign only one PVC per service record. When you define only one PVC per service record, upper-layer protocols treat the ATM network as a series of direct, point-to-point connections, viewing each PVC as an individual network interface.

You can, therefore, configure each PVC with different protocols and parameter settings. This allows you to connect to different network sites using, for example, different types of data encapsulation (Figure 5-4).

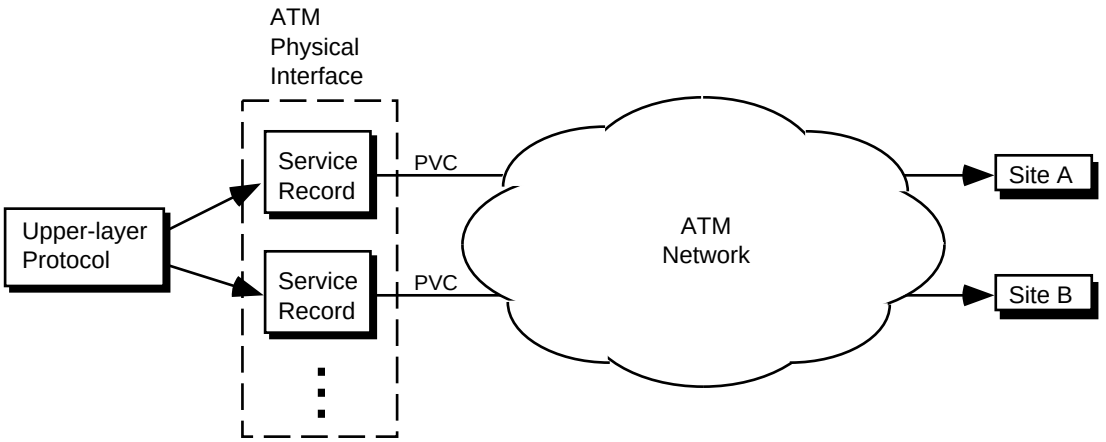


Figure 5-4. One PVC per Service Record

Assigning one PVC per service record allows you to dedicate a PVC to a particular protocol, but at the expense of some configuration overhead, memory, and address space.

This type of configuration is best suited to small, nonmeshed configurations, or to configurations in which protocols must reside on separate PVCs.

Note: *The maximum number of PVCs you can configure in this way varies, depending on the configuration of the router, the number of protocols running on the circuits, and the number of routing entries.*

Hybrid Access

PVCs do not typically allow for bridging in nonmeshed environments. If your network combines bridging and routing over the same interface, you need to use the service record portion of each PVC for routing, while at the same time allow bridging to operate. To do this, you must define the PVC as a hybrid/bridged VC.

Defining the PVC as a hybrid/bridged VC allows the bridge to view each PVC as a separate bridge interface while allowing the routing protocols to view all PVCs as part of the same interface (Figure 5-5).

Use hybrid PVCs when creating nonmeshed network configurations that use both bridging and routing over a single ATM interface. These PVCs work best for spanning tree bridging.

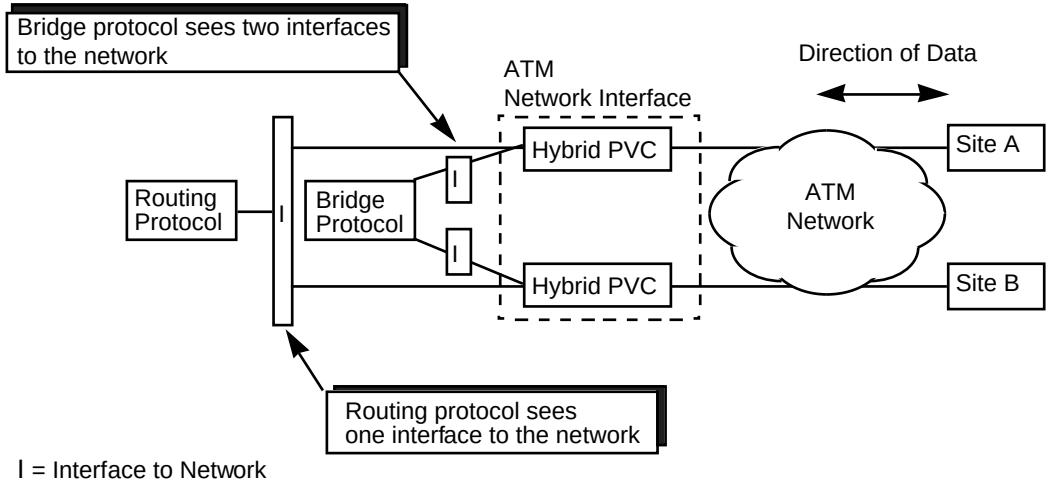


Figure 5-5. Hybrid PVCs

Note: *When you define a PVC as a hybrid/bridged VC, Site Manager provides additional Bridge, Spanning Tree, and Native Mode LAN (NML) protocol options. These protocols run on the PVC along with the protocols defined in the ATM service record.*

Using Hybrid PVCs for Transparent Bridging

In Figure 5-6, traffic bridges between Site A and Site B. The bridge (Router 1) is running on the ATM network interface, and its PVCs are *not* defined as hybrid/bridged VCs.

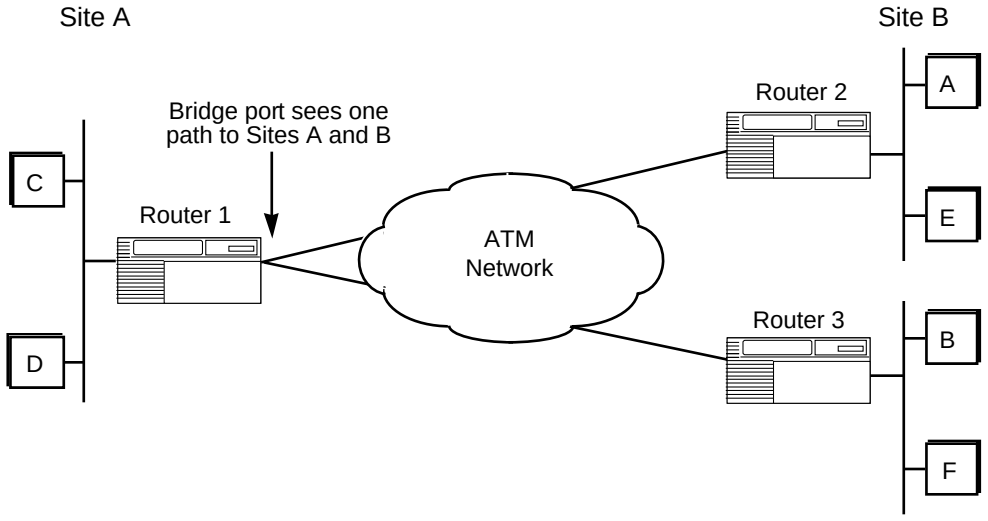


Figure 5-6. Example of a Bridged Network

In this example, the bridge receives data from Site A. If the bridge does not recognize the destination address, it tries to direct traffic through another bridge port. However, since the PVCs are not defined as hybrid/bridged VCs, the ATM bridge port views the paths to Site A and Site B as the same.

A bridge does not send out the same data over the bridge port from which it just received the data. This means that the bridge cannot direct the data to Site B. To resolve this problem, you need to designate the PVCs as hybrid/bridged VCs.

If you define the PVCs as hybrid VCs (refer to Figure 5-5), each PVC acts as a separate bridge port. This enables the bridge running on the ATM interface to view the traffic from Site A as arriving on a different port than that of Site B. When the bridge sends out data, it now has access to all its ports, including the port that accesses Site B. Therefore, data from Site A can reach Site B.

SVC Access Methods

SVCs use signaling messages to dynamically establish, maintain, and clear a switched virtual connection at the UNI. These messages (as defined by the Q.2931 standard for signaling protocol) allow the router to assess the availability of an ATM endpoint (device), establish a connection with that device, maintain that connection for the duration of data transfer, and then clear the connection when the transfer is complete.

ATM Traffic Parameters

The *ATM User-Network Interface Specification* defines several traffic parameters. These parameters help to prioritize and control the traffic on each VC.

How you assign your ATM traffic parameters depends on

- The characteristics (for example, maximum cell rate, average cell rate, burst size) of the individual connections that you want to set up
- The bit-rate method — variable or available — that the ATM ILI pair uses

You can change your ATM traffic parameters several times before deciding on a particular set. This section explains the different traffic parameters and provides some basic guidelines for customizing traffic parameters on an ATM PVC or ATM Control SVC (that is, the signaling VC or ILMI VC).

Note: *You do not need to manually configure traffic parameters for SVCs (as you must for PVCs and Control VCs), because SVCs dynamically negotiate these parameters before transferring data.*

Converting Mb/s to Cells/s

Several ATM traffic parameters require you to enter values in cells/second (cells/s). To convert to cells/s, divide the number of bits/s by 424 (the number of bits per ATM cell).

$$\frac{\textit{Number of bits/second}}{\textit{Number of bits/ATM cell}} = \textit{Number of cells/second}$$

For example:

$$\frac{\textit{100,000,000 bits/s}}{\textit{424 bits/cell}} = \textit{235,849 cells/s}$$

Although we use raw bandwidth to describe line rates, inherent overhead within the media limits maximum bandwidth for the line. Use Table 5-1 to determine the maximum bandwidth for the media you are using.

Table 5-1. Maximum Bandwidth

Media	Raw Bandwidth (Mb/s)	Maximum Bandwidth (Mb/s)	Maximum Cells/s
OC-3 SONET/SDH	155	149.76	353207
DS-3	44.736	40.704	96000
E-3 (G.832 Framing)	34.368	33.920	80000
E-3 (G.751 Framing)	34.368	30.528	72000

Variable Bit Rate versus Available Bit Rate

Bay Networks currently provides the following ATM ILI pairs:

- An ATM FRE2 link module in conjunction with a Fast Routing Engine (FRE2) processor
- An ATM Routing Engine link module in conjunction with an ATM Routing Engine (ARE) processor

Either ILI pair allows the router to connect directly to an ATM network over an ATM physical interface. However, depending on the ATM ILI pair, the method of determining bandwidth varies.

Variable Bit Rate

ATM FRE2 ILI pairs use variable bit rate (VBR) to determine bandwidth allocation. VBR allows the VC to accumulate credits whenever it does *not* use any bandwidth within its specified average. When this VC does use bandwidth, the accumulated credits allow it to transmit using the Peak Cell Rate (PCR).

Available Bit Rate

ATM ARE ILI pairs use available bit rate (ABR) to determine bandwidth allocation. ABR is a method by which the bandwidth is separated into a guaranteed portion (for PVCs and Control VCs) and an available portion (for data SVCs).

Note: *Bay Networks does not currently incorporate ABR congestion control features as defined by the ATM Forum.*

Peak Cell Rate

The peak cell rate (PCR) is the upper traffic rate limit for an individual VC. When setting the PCR, keep the following in mind:

- Each VC can have its own PCR.
- The PCR cannot exceed the maximum rate for the physical media. For example, you cannot exceed 149.76 Mb/s for a SONET/SDH line.

- The PCR specifies the desired rate for the attached physical media (that is, SONET/SDH, DS-3, or E-3). It does not specify the rate for the ATM network as a whole. For example, you can specify a full 149.76 Mb/s for each PVC or Control VC on a SONET/SDH connection. However, if the VC ultimately connects to a lower-speed link (for example, T1 or E1), your PCR is limited to the maximum rate of that media.
- ATM FRE2 ILI pairs require a minimum PCR value of 300 cells/s. VCs may fail to operate with PCR values less than 300 cells/s.
- ATM ARE ILI pairs require a minimum PCR value of 128 cells/s. VCs may fail to operate with PCR values less than 128 cells/s.
- The E-3 framing mode setting affects the maximum PCR setting. Refer to Table 5-1 for additional information.

Sustainable Cell Rate and Minimum Cell Rate

For ATM FRE2 ILI pairs, the sustainable cell rate (SCR) is the upper bound on the conforming average rate of an individual PVC or Control VC. In this definition, *average rate* is the number of cells transmitted over the link divided by the duration of the connection. The *duration of the connection* equals the total amount of time it takes from connection setup to connection release.

The SCR allows you to define future cell flow on a PVC or Control VC in greater detail than by just using the PCR. For ATM FRE2 ILI pairs, the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources. In other words, the SCR allows sufficient bandwidth for operation, but does not allow a bandwidth as high as the PCR.

For ATM ARE ILI pairs, the SCR value maps directly to a minimum cell rate (MCR) value. In other words, when you configure the SCR on an ATM ARE ILI pair, you actually configure the MCR. Instead of defining the upper bound of an average rate, like the SCR, the MCR defines the minimum amount of guaranteed bandwidth allowed for PVCs and Control VCs on the ATM line.

The MCR (that is, SCR) not only controls the rate over time, it guarantees this rate. In other words, the SCR provides sufficient bandwidth for SVC operation but, at the same time, guarantees the bandwidth for PVCs and Control VCs on the ATM line.

When setting the SCR for ATM FRE2 ILI pairs, keep the following in mind:

- The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VC to conform.
- To be useful, the SCR must not exceed the PCR.
- If you know the user average rate, set the SCR about 10% higher than this value.
- ATM FRE2 ILI pairs require a minimum SCR value of 300 cells/s. PVCs may fail to operate with SCR values less than 300 cells/s.

When setting the SCR for ATM ARE ILI pairs, keep the following in mind:

- The SCR maps directly to the MCR.
- The MCR provides guaranteed bandwidth for PVCs and Control VCs while allowing sufficient bandwidth for SVCs to operate.
- To be useful, the SCR must not exceed the PCR.
- If you know the user average rate, set the SCR about 10% higher than this value.
- ATM ARE ILI pairs require a minimum SCR value of 128 cells/s. VCs may fail to operate with SCR values less than 128 cells/s.
- ATM ARE ILI pairs allow you to enter an SCR value of 0. Entering 0 for the SCR turns off this function.
- The E-3 framing mode setting affects the maximum SCR setting. Refer to Table 5-1 for additional information.

Maximum Burst Size

For ATM FRE2 ILI pairs, the maximum burst size (MBS) is the maximum length of a cell stream allowed on a particular VC. The MBS specifies the maximum number of sequential cells allowed on a VC before that VC must relinquish bandwidth to other VCs waiting to transmit. This burst occurs at or close to the Peak Cell Rate.

When setting the MBS, we suggest that you select a value larger than the largest packet your PVC or Control VC can transmit (that is, the Maximum AAL CPCS Transmit SDU size). For example, if your VC accepts packets that are less than 2358 bytes long (PVC default), set your MBS value between 45 and 50 cells.

Note: *ATM ARE ILI pairs ignore the maximum burst size.*

As a guideline, use the formula below to determine your MBS value:

$$\frac{\textit{Maximum Packet Size (in bytes)}}{\textit{48 bytes/cell}} = \textit{MBS value (in cells)}$$

For example:

$$\frac{\textit{2358 bytes (PVC default)}}{\textit{48 bytes/cell}} = \textit{49 cells}$$

Chapter 6
Enabling ATM Service

Before you can enable ATM service you must

1. Open a configuration file.
2. Specify router hardware (if using a local-mode configuration file).
3. Select the link module interface on which you are enabling ATM.

If you have questions about how to perform any of these preliminary tasks, refer to *Configuring Routers*.

For each ATM parameter, this chapter provides information about default settings, valid parameter options, the parameter function, instructions for setting the parameter, and the Management Information Base (MIB) object ID.

The Technician Interface allows you to modify parameters by issuing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager.

For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

Caution: *We highly recommend that you use the Technician Interface for very minor MIB adjustments only. The Technician Interface does not verify that the value you enter for a parameter is valid. Entering an invalid value can corrupt your configuration.*

Enabling Overview

When you enable ATM service, you must

1. Add an ATM circuit.
2. Define initial ATM signaling parameters for that circuit.
3. Add and define an ATM service record for that circuit.
4. Enable any desired protocols on that service record.
5. Add at least one virtual circuit (PVCs only) to that service record.

If you want to edit any specific ATM parameters or add more VCs, refer to Chapter 8.

Adding an ATM Circuit

To enable ATM on an interface:

1. **Click on an ATM link module interface (labeled ATM1) in the Configuration Manager window (Figure 6-1).**

   The Add Circuit window opens (Figure 6-2).

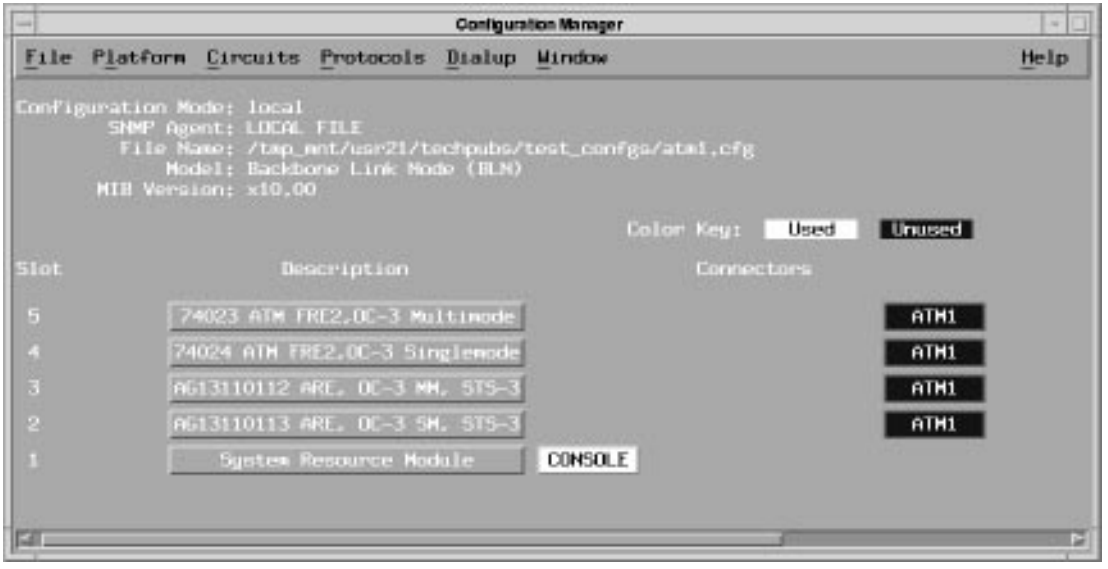


Figure 6-1. Configuration Manager Window

Figure 6-2. Add Circuit Window

2. Click on OK.

The Initial ATM Signaling Config window opens (Figure 6-3).

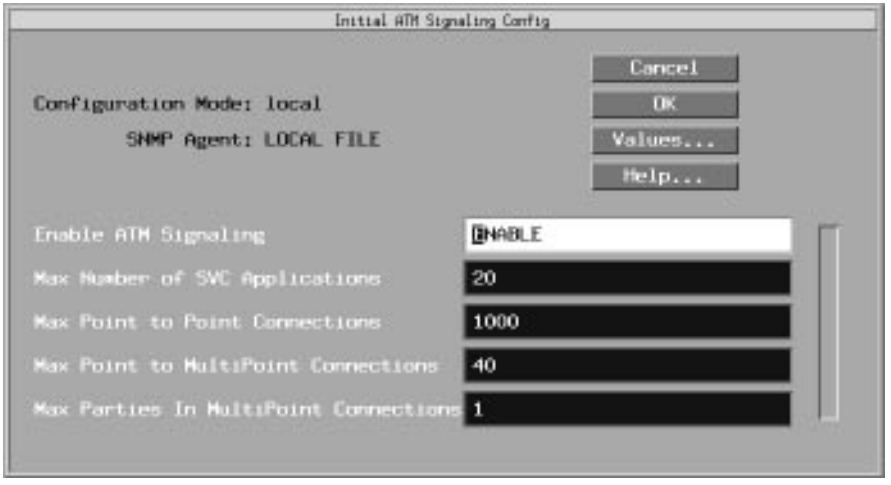


Figure 6-3. Initial ATM Signaling Config Window

3. **Click on OK to accept the default settings or edit the parameters.**

   Refer to the next section for guidelines.

4. **Click on OK.**

   The Edit ATM Connector window opens (Figure 6-4).

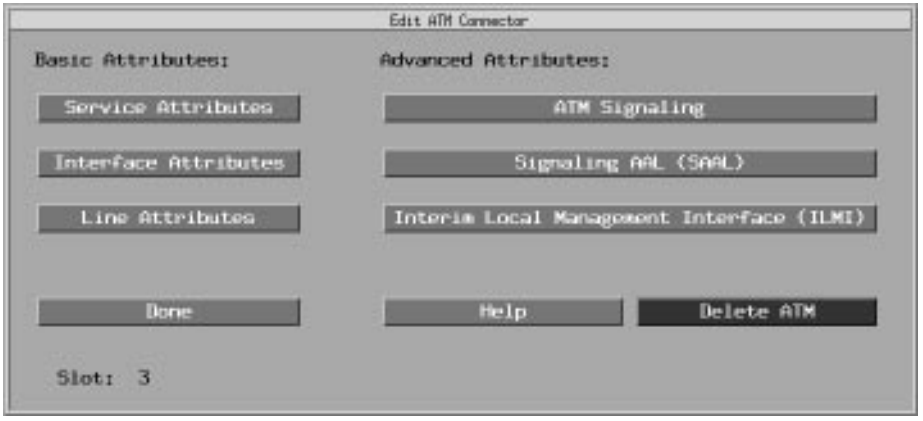


Figure 6-4. Edit ATM Connector Window

5. **Go to "Adding a Service Record" later in this chapter.**

Initial ATM Signaling Config Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters in the Initial ATM Signaling Config window.

Parameter:	**Enable ATM Signaling**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables the ATM signaling for this ATM circuit.
Instructions:	Accept the default, Enable, if you want to enable ATM signaling on this circuit. Set this parameter to Disable if you do not want to enable ATM signaling on this circuit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.2

Note: *When you disable signaling on the interface, the ATM Service Record Parameters window automatically sets the Data Encapsulation Type parameter to* LLC/SNAP *and the Virtual Connection Type parameter to* PVC.

Parameter:	**Max Number of SVC Applications**
Default:	20
Range:	1 to 32767
Function:	Identifies the maximum number of service access points (SAPs) allowed for this circuit. The number of SAPs corresponds to the number of LAN emulation or IP (RFC 1577) clients allowed for the circuit.
Instructions:	Accept the default, 20, or enter a value from 1 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.6

Parameter:	**Max Point to Point Connections**
Default:	1000
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous point-to-point connections allowed for this circuit.
Instructions:	Accept the default, 1000, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.7

Parameter:	**Max Point to Multipoint Connections**
Default:	40
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous point-to-multipoint connections allowed for this circuit.
Instructions:	Accept the default, 40, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.8

Parameter:	**Max Parties in Multipoint Connections**
Default:	1
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous parties in a point-to-multipoint connection allowed for this circuit.
Instructions:	Accept the default, 1, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.9

Adding a Service Record

The Configuration Manager allows you to add service records for a specific data encapsulation type. Depending on the data encapsulation type you choose, the Configuration Manager also allows you to select a PVC or SVC virtual connection type for that service record.

Caution: *You cannot edit the Data Encapsulation Type or Virtual Connection Type parameters, once you assign them to a service record.*

Table 6-1 identifies which data encapsulation types you can apply to permanent and switched virtual circuits.

Table 6-1. Valid Data Encapsulation Types for PVCs and SVCs

Data Encapsulation Type	Permanent Virtual Circuit	Switched Virtual Circuit
LANE 802.3		✔
LLC/SNAP	✔	✔
NULL	✔	✔

Note: *For an explanation of the different data encapsulation types, and rules for assigning data encapsulation, refer to Chapter 7.*

Adding a Service Record for PVCs

To add a service record for permanent virtual circuits:

1. **Click on Service Attributes in the Edit ATM Connector window (refer to Figure 6-4).**

   The ATM Service Records List window opens (Figure 6-5).

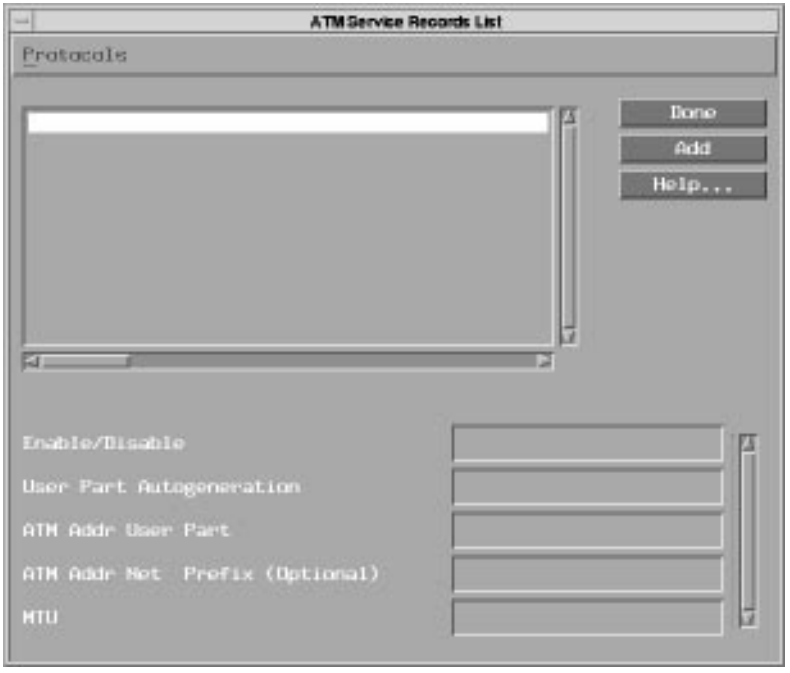


Figure 6-5. ATM Service Records List Window

2. **Click on Add.**

   The ATM Service Record Parameters window opens (Figure 6-6).

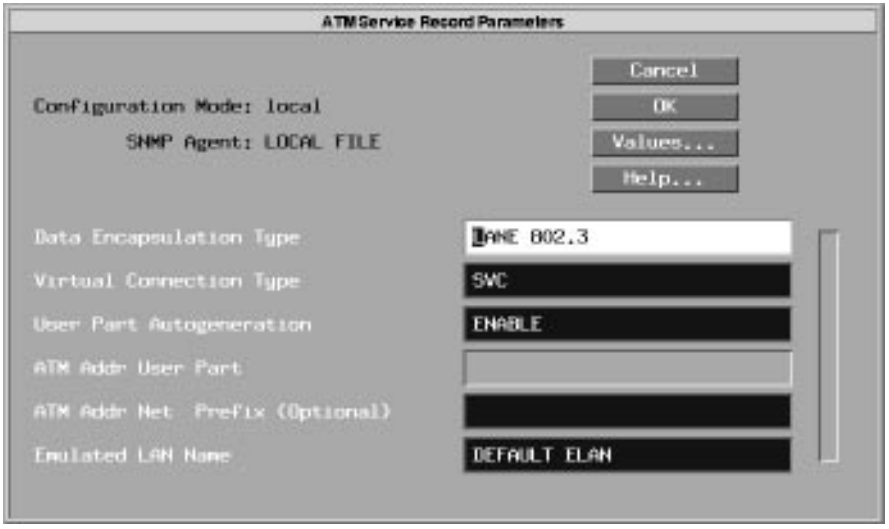


Figure 6-6. ATM Service Record Parameters Window

Note: *If you disabled signaling in the Initial ATM Signaling Config window (refer to Figure 6-3), the ATM Service Record Parameters window automatically sets the default for the Data Encapsulation Type parameter to* LLC/SNAP *and the Virtual Connection Type parameter to* PVC.

3. **Change the Data Encapsulation Type parameter from LANE 802.3 (the default) to LLC/SNAP or NULL.**

Note: *For an explanation of the different data encapsulation types, and rules for assigning data encapsulation, refer to Chapter 7.*

4. **Change the Virtual Connection Type parameter from SVC to PVC.**

Note: *You must use the Return key or Tab key to advance to the Virtual Connection Type parameter. Using either the Return or Tab key acknowledges the data encapsulation type selection. If you do not acknowledge the data encapsulation type selection, the Configuration Manager does not provide PVC as an option for the Virtual Connection Type parameter.*

5. **Click on OK.**

   The Select Protocols window opens (Figure 6-7).

6. **Go to "Enabling Protocols on an ATM Service Record," later in this chapter.**

Adding a Service Record for SVCs

To add a service record for switched virtual circuits:

1. **Click on Service Attributes in the Edit ATM Connector window (refer to Figure 6-4).**

   The ATM Service Records List window opens (refer to Figure 6-5).

2. **Click on Add.**

   The ATM Service Record Parameters window opens (refer to Figure 6-6).

   If you want to change any of the parameters in the ATM Service Record Parameters window, refer to Chapter 8 for instructions.

Note: *If you do not enter an ATM address user part, the Configuration Manager uses the MAC address of the interface (or the MAC address override from the ATM Interface Attributes window) as the first six bytes of the address. The Configuration Manager then adds a selector byte, unique to this interface, to complete the address.*

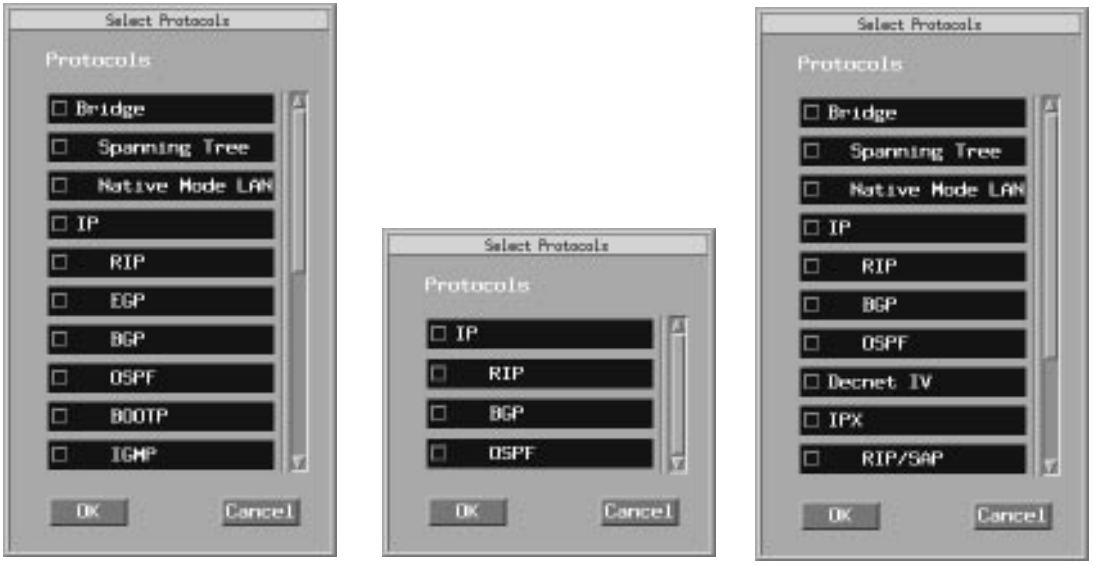
3. **Click on OK.**

   The Select Protocols window opens. The contents of this window vary, depending on the settings in the ATM Service Record Parameters window.

4. **Go to the next section, "Enabling Protocols on an ATM Service Record."**

Enabling Protocols on an ATM Service Record

Depending on the data encapsulation type and virtual connection type (PVC or SVC) you choose for the service record, the Configuration Manager provides the Select Protocols window containing one of three protocol lists (Figure 6-7).



For PVCs | For SVCs Using LLC/SNAP or NULL | For SVCs Using LANE 802.3

Figure 6-7. Select Protocols Windows

Table 6-2 lists all supported protocols for standard PVCs and SVCs using LLC/SNAP, NULL, or LANE 802.3 data encapsulation.

Table 6-2. Supported Protocols

PVC	SVC Using LLC/SNAP or NULL (RFC 1577)	SVC Using LANE 802.3
Bridge	IP	Bridge
- Spanning Tree	- RIP	- Spanning Tree
- Native Mode LAN	- BGP	- Native Mode LAN
IP	- OSPF	IP
- RIP		- RIP
- EGP		- BGP
- BGP		- OSPF
- OSPF		DECnet IV
- BOOTP		IPX
- IGMP		- RIP/SAP
— DVMRP		AppleTalk
- NetBIOS		LLC2
DECnet IV		DLSw
IPX		
- RIP/SAP		
XNS		
- RIP (XNS)		
AppleTalk		

Enabling Protocols on a PVC Service Record

To enable protocols on a PVC service record:

1. **Click on the protocol or protocols you want to enable in the Select Protocols window (refer to Figure 6-7).**
2. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the ATM Virtual Channel Link window opens (Figure 6-8).

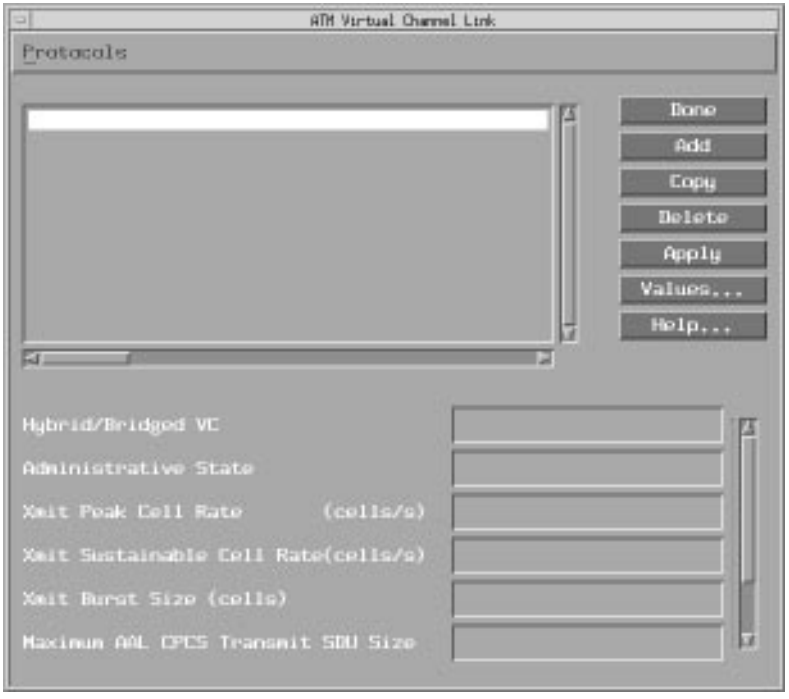


Figure 6-8. ATM Virtual Channel Link Window

3. **A PVC service record requires at least one PVC to operate; go to "Adding PVCs," later in this chapter.**

Enabling Classical IP on an SVC Service Record

When you select either NULL or LLC/SNAP (RFC 1483) data encapsulation to run on an SVC, you automatically select the technology defined in RFC 1577, "Classical IP and ARP over ATM." This technology allows you to set up logical IP subnets within your ATM network and provides the ability to use ARP to obtain information, and receive that information from a designated ATM ARP server.

For additional information about RFC 1577 and how to configure logical IP subnets on an ATM network, refer to Appendix C.

To enable classical IP protocols on an SVC service record running LLC/SNAP or NULL encapsulation:

1. **Click on the IP protocols you want to enable in the Select Protocols window (refer to Figure 6-7).**
2. **Click on OK.**

   For each IP protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns to the ATM Service Records List window (refer to Figure 6-5).

Note: *After you add protocols to an LLC/SNAP or NULL switched virtual circuit, the Configuration Manager adds an SVC button to the ATM Service Records List window.*

Clicking on the SVC button opens the SVC window. This window allows you to view and delete individual SVCs from the service record (in dynamic mode only). For additional information on how to delete individual SVCs, refer to Chapter 7.

Enabling Protocols on an SVC Service Record Running LANE 802.3

Selecting LANE 802.3 to run on an SVC service record defines that service record as an emulated Ethernet LAN. This means that any protocols on that service record operate as if they were running over a traditional Ethernet LAN.

For additional information about LAN Emulation over ATM, refer to Appendix B.

To enable protocols on an SVC service record running LANE 802.3:

1. **Click on the protocols you want to enable in the Select Protocols window (refer to Figure 6-7).**
2. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns to the ATM Service Records List window (refer to Figure 6-5).

Note: *After you add protocols to a LANE 802.3 switched virtual circuit, the Configuration Manager adds both an SVC button and a LEC (LAN Emulation Client) button to the ATM Service Records List window.*

Clicking on the SVC button opens the ATM Switched Virtual Circuit window. This window allows you to view and delete individual SVCs from the service record (in dynamic mode only). For additional information on how to delete individual SVCs, refer to Chapter 7.

Clicking on the LEC button opens the ARE LAN Emulation Parameters window. For additional information about editing LAN emulation parameters, refer to Chapter 8.

Adding PVCs

A PVC service record requires at least one PVC to operate. To add a PVC:

1. **Click on Add in the ATM Virtual Channel Link window (refer to Figure 6-8).**

   The ATM Virtual Channel Link Parameters window opens (Figure 6-9).

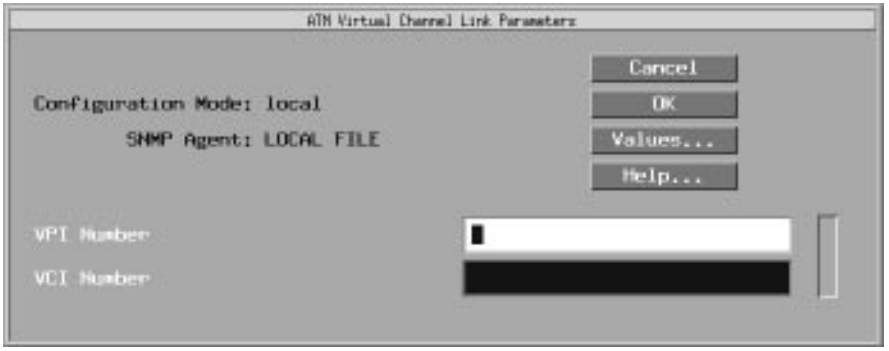


Figure 6-9. ATM Virtual Channel Link Parameters Window

2. **Enter the virtual path identifier (VPI) and virtual channel identifier (VCI) numbers that you want to use for the PVC.**

   Refer to the next section for guidelines.

3. **Click on OK.**

   The Configuration Manager returns you to the ATM Virtual Channel Link window (refer to Figure 6-8). If you want to change any of the parameters in the ATM Virtual Channel Link window, refer to Chapter 8 for instructions.

4. **If you want to add another PVC with the default configuration, repeat Steps 1 through 3.**

5. **Click on Done.**

   The Configuration Manager returns you to the ATM Service Records List window (refer to Figure 6-5).

ATM Virtual Channel Link Parameters

Use the following descriptions as guidelines when you configure the parameters in the ATM Virtual Channel Link Parameters window.

Note: *ATM does not allow duplicate VPI/VCI pairs on the same ATM physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, on different link modules).*

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the PVC. The VPI (virtual path identifier) is part of the cell header. The header can contain a maximum of 8 VPI bits for a UNI connection. This bit range allows for path identifiers from 0 to 255.
Instructions:	Enter a VPI value from 0 to 255.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.3

Parameter:	**VCI Number**
Default:	None
Range:	32 to 65535
Function:	Identifies the virtual channel of the PVC. The VCI (virtual channel identifier) is part of the cell header. The header can contain a maximum of 16 VCI bits. This bit range allows for path identifiers from 0 to 65535.
Instructions:	Enter a value from 32 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.4

Note: *Following the recommendation of the ATM Forum, virtual channel identifiers from 0 to 31 are reserved for added functionality.*

Chapter 7
ATM Editing Basics

Once you enable an ATM circuit, you can use the Configuration Manager to edit ATM parameters. Many ATM parameters are interdependent, that is, how you edit some parameters depends on how you set others.

Before you begin editing any ATM parameters, we suggest you read this chapter to understand

- The methods of accessing ATM parameter windows
- The function and flow of each ATM parameter window
- How to configure data encapsulation
- Where and how to edit protocols
- The various ways you can delete ATM

Accessing ATM Windows

You can access the same ATM windows from either

- The Edit ATM Connector window (Figure 7-2)
- The Protocols menu in the Configuration Manager window (Figure 7-3)

Note: *For you to access ATM windows using the Configuration Manager Protocols menu, an ATM interface must already contain at least a basic configuration. This means you cannot enable an ATM interface using the Protocols menu. You must use the Edit ATM Connector window to enable an ATM interface.*

Although you can access the same ATM windows using either the Protocols menu or the Edit ATM Connector window, the information provided by each access method is slightly different.

Note: *The Protocols menu in the Configuration Manager does not provide access to ATM line parameters. Since line parameters are specific to an interface, you can access these parameters through a specific ATM interface.*

Using the Edit ATM Connector Window

The Edit ATM Connector window (Figure 7-2) acts as a control access point for all ATM parameters. This window provides information specific to each individual ATM interface.

For any given interface, this window provides several attribute buttons. By clicking on any of these buttons, you can access and edit various parameters associated with that specific ATM interface (connector).

The Edit ATM Connector window separates the attribute buttons into the following categories:

- ATM service record, interface, and line attributes
- Signaling, Signaling AAL (SAAL), and ILMI attributes

The Edit ATM Connector window also allows you to delete ATM from the interface entirely (see “Deleting ATM from an Interface,” later in this chapter, for details).

To use the Edit ATM Connector window:

1. **Click on an ATM link module interface (labeled ATM1) in the Configuration Manager window (Figure 7-1).**

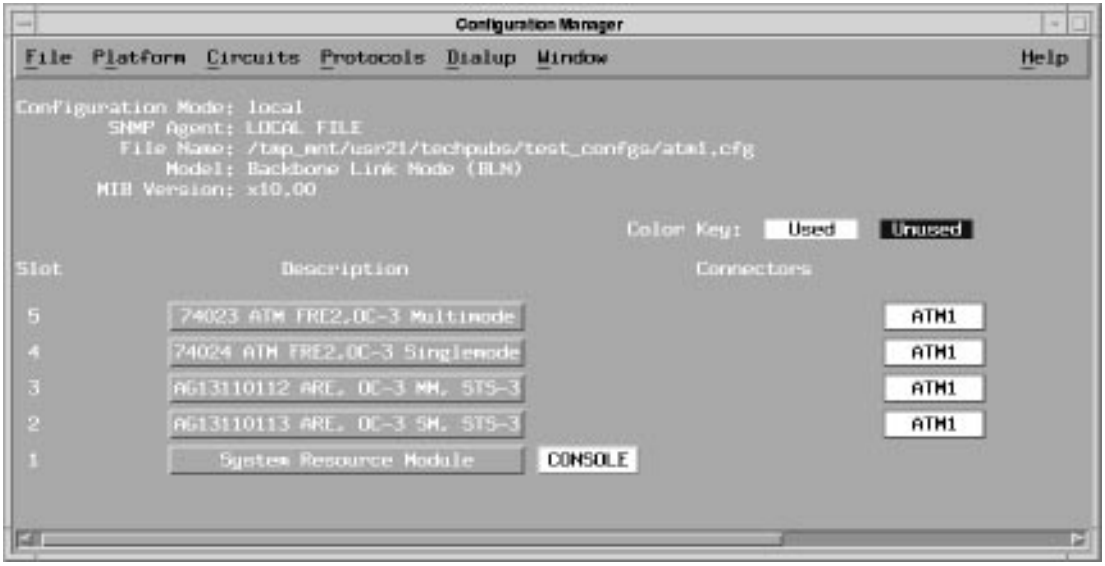


Figure 7-1. Configuration Manager Window

— If you have not already enabled the interface, the Add Circuit window opens. Go to Chapter 6 to learn how to enable an ATM interface.

— If the interface is already enabled, the Edit ATM Connector window opens (Figure 7-2).

Figure 7-2. Edit ATM Connector Window

2. Click on the desired attribute category.

To learn more about each ATM attribute category, go to the section in this chapter that describes how to navigate within each attribute category.

To learn more about how to edit the different ATM parameters, go to the section that describes how to edit a specific attribute category. Table 7-1 lists each attribute category and its location.

Table 7-1. Finding Editing Instructions (Edit ATM Connector)

To learn how to edit	Go to this section	In
Service attributes	Editing Service Attributes	Chapter 8
Interface attributes	Editing ATM Interface Attributes	Chapter 8
Line attributes	The ATM section	*Configuring Line Services*
ATM signaling	Editing ATM Signaling Attributes	Chapter 9
Signaling AAL (SAAL)	Editing Signaling AAL Attributes	Chapter 9
Interim Local Management Interface (ILMI)	Editing ILMI Attributes	Chapter 9

Using the Configuration Manager Protocols Menu

When you access ATM windows using the Protocols menu in the Configuration Manager window (Figure 7-3), you receive global information about every ATM interface on the router. For example, if you configure four ATM link modules on the router, and you select Service Records from the Protocols menu, the ATM Service Records List window displays all of the service records that you have configured on the router.

Figure 7-3. Configuration Manager Protocols Menu

To access an ATM attribute category window:

1. **Click on the Configuration Manager Protocols menu (Figure 7-3).**
2. **Click on ATM.**
3. **Click on the desired ATM attribute category in the menu.**

To learn more about each ATM attribute category, go to the section in this chapter that describes each attribute category.

To learn more about how to edit the different ATM parameters, go to the appropriate section or guide that describes how to edit a specific attribute category. Table 7-2 lists each attribute category and its location.

Table 7-2. Finding Editing Instructions (Protocols Menu)

To learn how to edit	Go to this section	In
Service Records	Editing Service Attributes	Chapter 8
ATM Signaling	Editing ATM Signaling Attributes	Chapter 9
Signaling AAL	Editing Signaling AAL Attributes	Chapter 9
ILMI Signaling	Editing ILMI Attributes	Chapter 9
Interfaces	Editing ATM Interface Attributes	Chapter 8

Selecting Service Attributes

Service attributes define the ATM service records for an interface. Selecting this category opens the ATM Service Records List window (Figures 7-4 and 7-6).

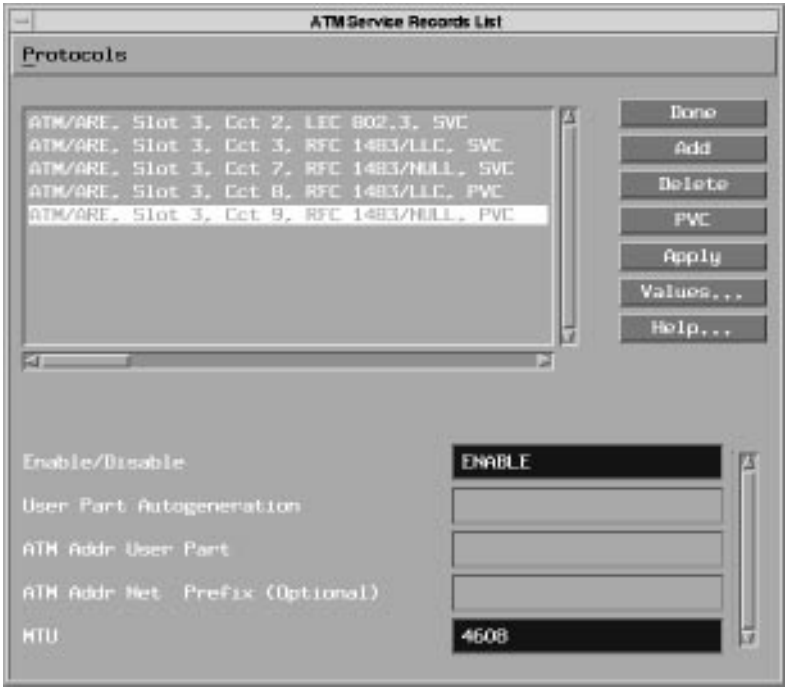


Figure 7-4. ATM Service Records List Window (PVC)

The ATM Service Records List window also provides access to

- Specific PVC parameters (PVC service records only)
- A list of all SVCs on that service record (SVC service records only)
- Access to LAN emulation client (LEC) attributes (SVC service records using LANE 802.3 data encapsulation)

Figure 7-5 shows the sequence of windows that can appear when you select the service attributes category and configure a PVC.

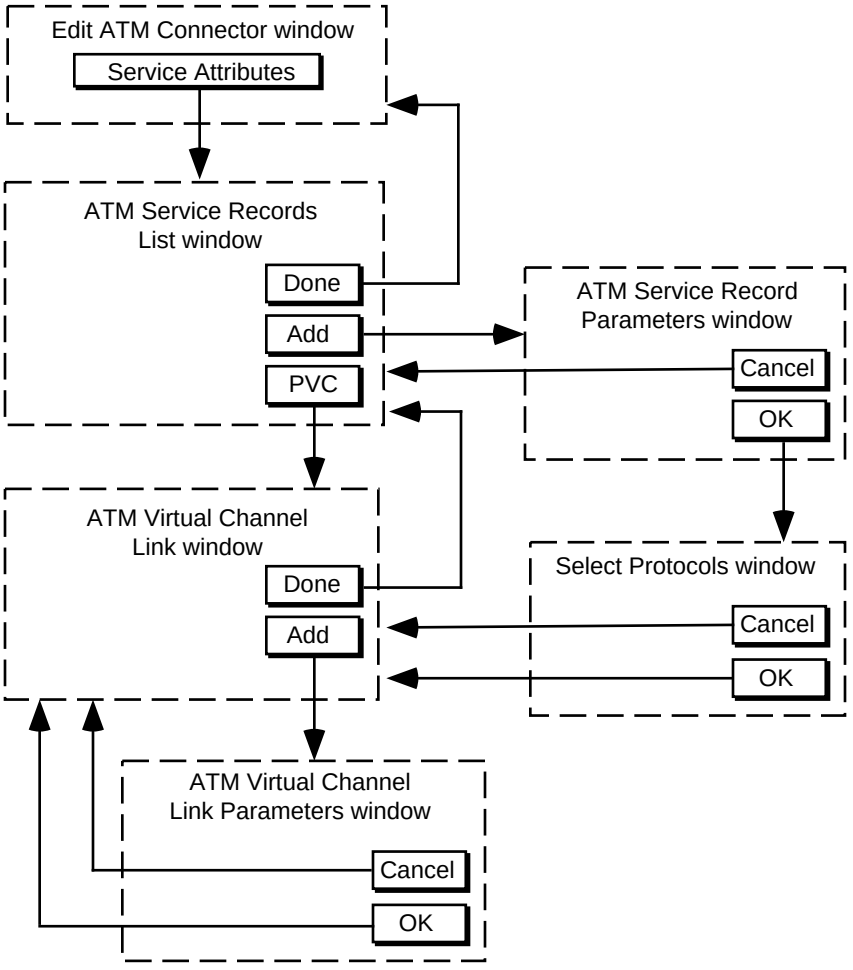


Figure 7-5. Service Attributes Window Sequence (PVCs)

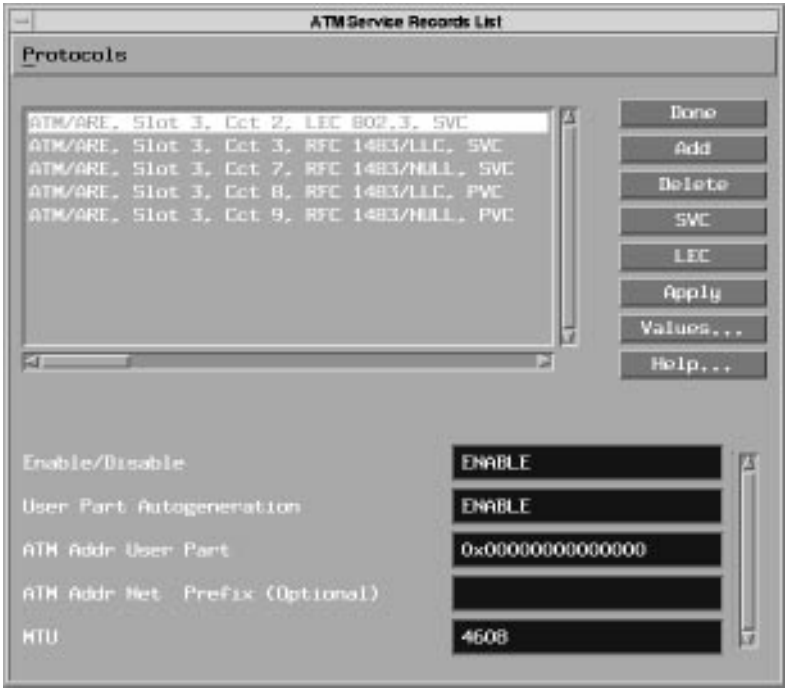


Figure 7-6. ATM Service Records List Window (SVC with LANE 802.3)

Figure 7-7 shows the sequence of windows that can appear when you select the service attributes category and configure an SVC with LAN emulation.

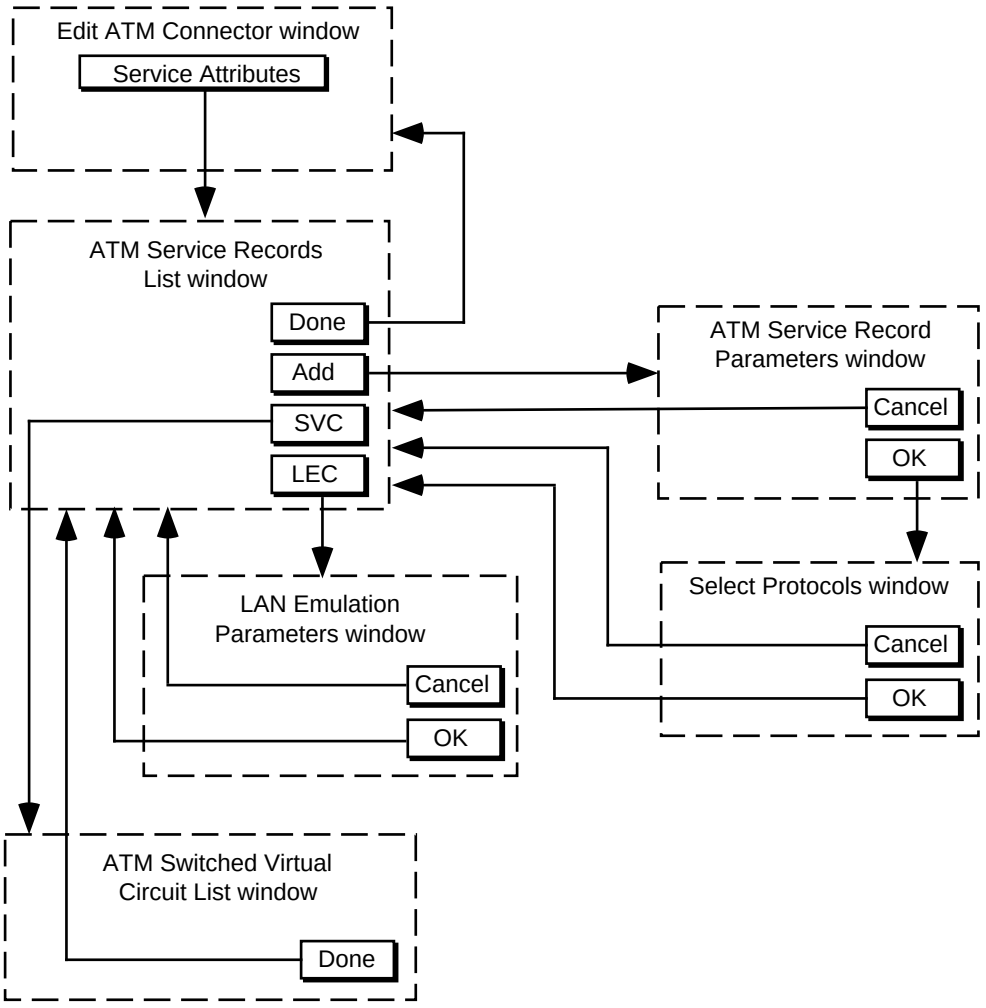


Figure 7-7. Service Attributes Window Sequence (SVCs with LAN Emulation)

Note: *With the exception of the LAN Emulation Parameters window, the service attributes window sequence for an SVC running LLC/SNAP or NULL data encapsulation (RFC 1577) is the same as in Figure 7-7.*

Selecting Interface Attributes

Interface attributes define the state of the ATM interface. Selecting this category opens the ATM Interface Attributes window (Figure 7-8).

Figure 7-8. ATM Interface Attributes Window

Figure 7-9 shows the window sequence for the interface attributes category.

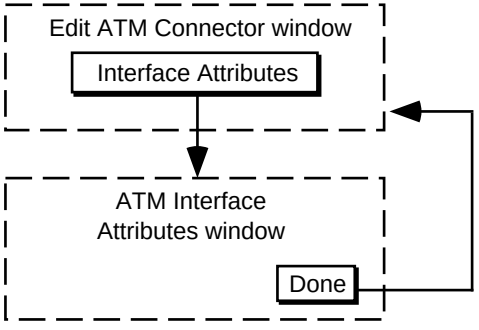


Figure 7-9. Interface Attributes Window Sequence

Selecting Line Attributes

Line attributes define the ATM line. Selecting this category opens either the ATM or ATM/ARE Line Driver Attributes window (Figure 7-10).

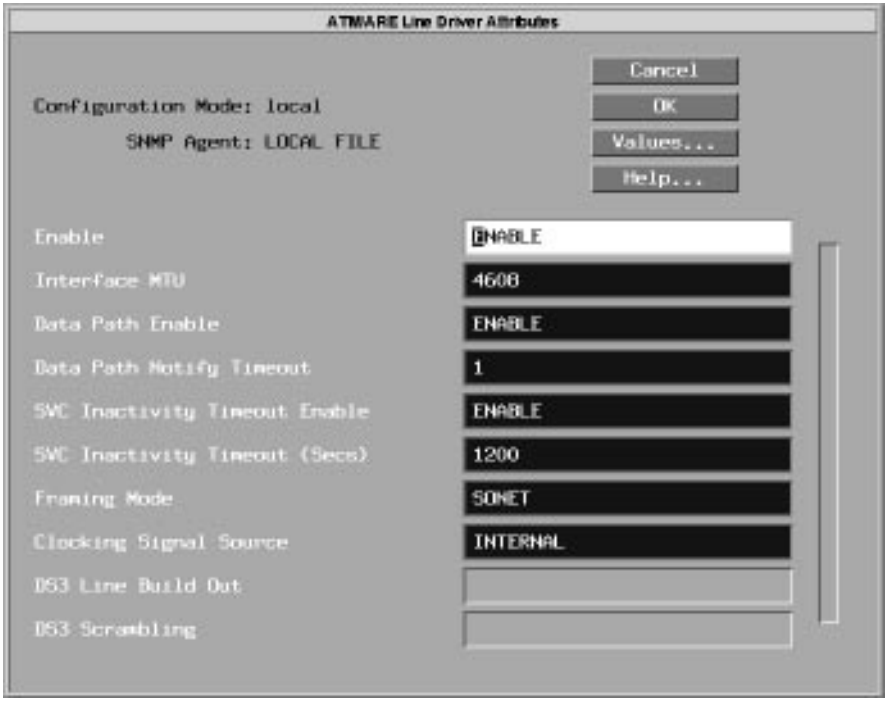


Figure 7-10. ATM/ARE Line Driver Attributes Window

For more information about the Line Driver Attributes windows and how to edit ATM line parameters, refer to *Configuring Line Services*.

Selecting ATM Signaling

ATM Signaling attributes define the connection and timer limits the router uses to set up, maintain, and clear a switched connection. Selecting this category opens the ATM Signaling Parameters window (Figure 7-11).

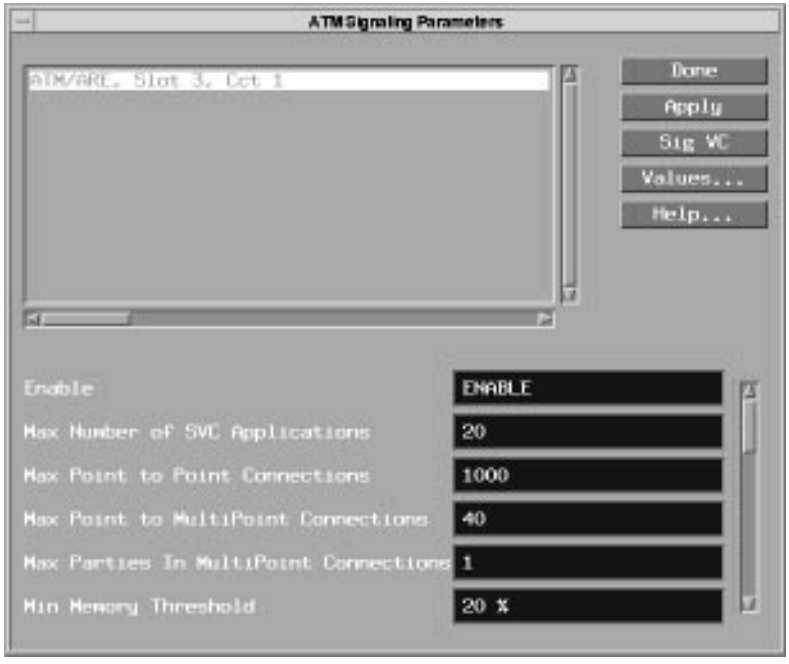


Figure 7-11. ATM Signaling Parameters Window

The ATM Signaling Parameters window also provides access to the signaling VC parameters. The signaling VC provides a dedicated VPI (0) and VCI (5) for ATM signaling functions.

Caution: *The signaling VC (0/5) and the ILMI VC (0/16) are reserved. These VCs remain in an operational state as long as signaling is enabled on the ATM interface. Because most ATM devices use these VPI/VCI pairs for signaling, we recommend that you not change these values.*

Figure 7-12 shows the window sequence for the ATM signaling category.

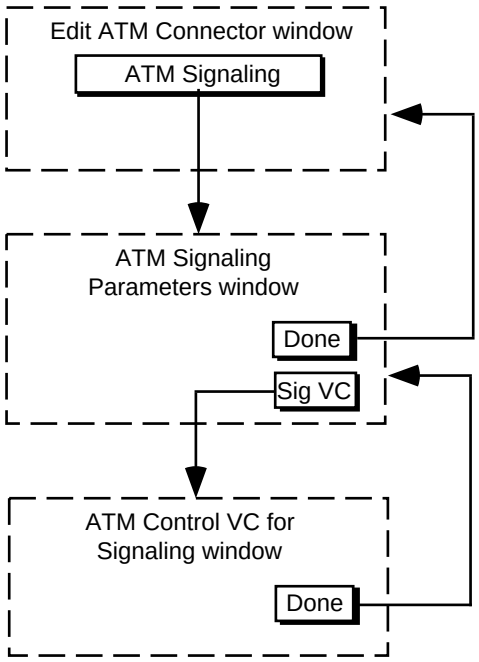


Figure 7-12. ATM Signaling Parameters Window Sequence

Selecting SAAL Attributes

Signaling AAL (SAAL) attributes define the connection and timer parameters the router uses to maintain a switched connection. SAAL provides reliable transport of signaling messages within the ATM protocol reference model. Selecting this category opens the ATM Signaling AAL Records List window (Figure 7-13).

Figure 7-13. ATM Signaling AAL Records List Window

Figure 7-14 shows the window sequence for the SAAL category.

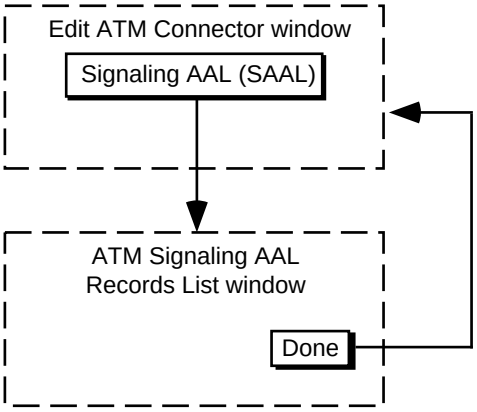


Figure 7-14. ATM Signaling AAL Records List Window Sequence

Selecting ILMI Attributes

ILMI attributes define the SNMP timers and retry limits for registration with the ATM switch. Selecting this category opens the ATM ILMI Signaling Parameters window (Figure 7-15).

Figure 7-15. ATM ILMI Signaling Parameters Window

Figure 7-16 shows the window sequence for the ILMI category.

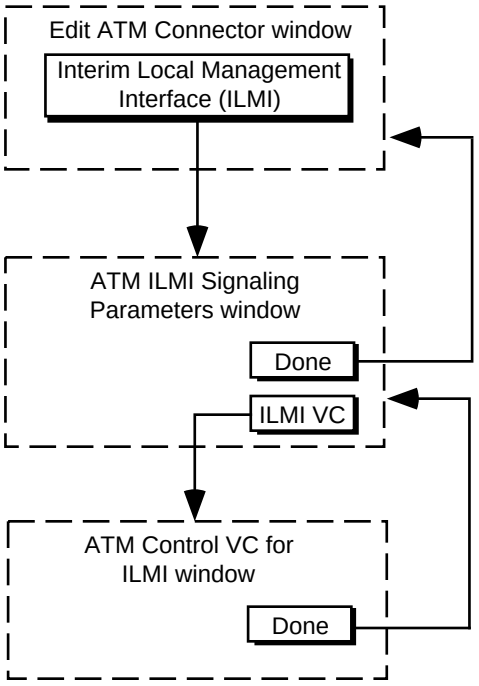


Figure 7-16. ATM ILMI Signaling Parameters Window Sequence

Assigning Data Encapsulation

ATM allows you to choose from three data encapsulation types: LLC/SNAP, LANE 802.3, and NULL. How you assign a data encapsulation type and which data encapsulation type takes precedence depend on the virtual circuit type and, for PVCs, the order in which you assign the encapsulation type.

Encapsulation Methods

Each ATM device must encapsulate PDUs in an ATM cell before it can send them over the ATM network.

LLC/SNAP Encapsulation

This method allows multiplexing of multiple protocols over a single ATM virtual circuit. In this approach, an IEEE 802.2 Logical Link Control (LLC) header prefixes each PDU. You can assign LLC/SNAP encapsulation to

- PVC service records
- SVC service records
- Individual PVCs

Note: *Assigning LLC/SNAP to an SVC service record automatically invokes the technology defined in RFC 1577, "Classical IP and ARP over ATM."*

NULL Encapsulation

RFC 1483 refers to this method as "VC-based multiplexing." This method performs higher-layer protocol multiplexing implicitly using ATM virtual circuits. You can assign NULL encapsulation to

- PVC service records
- SVC service records
- Individual PVCs

Note: *Assigning NULL to an SVC service record automatically invokes the technology defined in RFC 1577, "Classical IP and ARP Over ATM."*

LANE 802.3

LANE 802.3 provides Ethernet encapsulation of ATM PDUs for transmission over an emulated Ethernet LAN. You can assign LANE 802.3 to SVCs only.

Selecting a Data Encapsulation Method

Generally speaking, the designers of these data encapsulation methods envisioned that NULL encapsulation would dominate in environments where dynamic creation of large numbers of ATM VCs is fast and economical. These conditions usually exist in private ATM networks.

LLC/SNAP encapsulation is an alternative for environments in which it is not practical to have a separate VC for each carried protocol (for example, if the ATM network supports only PVCs, or if charging depends heavily on the number of simultaneous virtual circuits).

The choice of multiplexing methods that two ATM stations use to exchange connectionless network traffic depends on the type of virtual circuit involved:

- For PVCs, you select the multiplexing method when you manually configure the connection.
- For SVCs, the stations themselves negotiate the multiplexing method by sending B-ISDN signaling messages. These messages include “low-layer compatibility” information that allows negotiation of AAL5 and the carried (encapsulation) protocol.

Note: *Routed and bridged PDUs are always encapsulated within the payload field of the AAL5 CPCS PDU, regardless of the selected multiplexing method.*

LLC/SNAP Encapsulation

When the same virtual circuit carries several protocols, select LLC/SNAP encapsulation. LLC/SNAP encapsulation attaches an LLC/SNAP header before the PDU. This header includes information that the receiver needs to properly process the incoming PDU. For bridged PDUs, this header also includes the type of the bridged media.

NULL Encapsulation (VC-Based Multiplexing)

In NULL encapsulation, the carried network protocol is identified implicitly by the virtual circuit connecting the two ATM stations. Because each protocol must travel over a separate virtual circuit, there is no need to include explicit multiplexing information in the payload of the PDU. This means that the bandwidth requirements and processing overhead remain minimal.

You can either manually configure the carried protocol or let the signaling procedures negotiate it dynamically during call establishment.

NULL encapsulation cells do not receive a header in a routed environment. In a bridged environment, the content of the PDU itself includes the necessary information for bridging the multiplexed protocols.

Encapsulation Rules for PVCs

When assigning a data encapsulation type to a PVC or group of PVCs, keep the following in mind:

- The ATM Service Records List and ATM Virtual Channel Link windows initially contain a default data encapsulation type of LLC/SNAP.
- When you add a PVC, it reads and uses the data encapsulation type specified in its ATM service record.
- You can globally assign a data encapsulation type to all nonhybrid PVCs in a particular service record, or you can assign a data encapsulation type to individual group PVCs using the ATM Virtual Channel Link window.

Caution: *Changing the data encapsulation type in the ATM Service Records List window changes the data encapsulation type for all group access mode PVCs on that service record. For example, if you change the ATM service record data encapsulation type from LLC/SNAP to NULL, the data encapsulation type for all PVCs (except hybrid PVCs) on that service record changes to NULL. Site Manager does not ask you to verify this change.*

- If you change the data encapsulation value in the ATM Service Records List window, all new PVCs that you add to that service record use the new value.
- You must assign a data encapsulation type to hybrid mode PVCs individually, using the ATM Virtual Channel Link window. You cannot assign data encapsulation to a hybrid mode PVC using the service record.
- When you use the copy function, the new PVC uses the data encapsulation type of the existing PVC.

Using ATM Protocol Menus

Depending on the type of virtual circuit you are using, ATM requires you to add, delete, and edit protocols using specific protocol menus. Refer to Table 7-3 to locate and use the appropriate protocol menu for each access mode.

Table 7-3. Locating and Using Protocol Menus

Menu Location	PVCs and SVCs	Hybrid PVCs Only
ATM Service Record List window	✔*†	✔†
ATM Virtual Channel Link window		✔*

* For nonbridging protocols
† For bridging protocols

Remember, hybrid PVCs use their service record configurations for nonbridging protocols and their individual configurations for their bridging protocols. Refer to Chapter 5 for hybrid access mode implementation notes.

Using the Service Record Protocols Menu

Each ATM service record globally controls

- All protocols for any standard PVCs and SVCs that it contains
- All nonbridging protocols for any hybrid PVCs that it contains

To add or delete a protocol:

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 7-17).

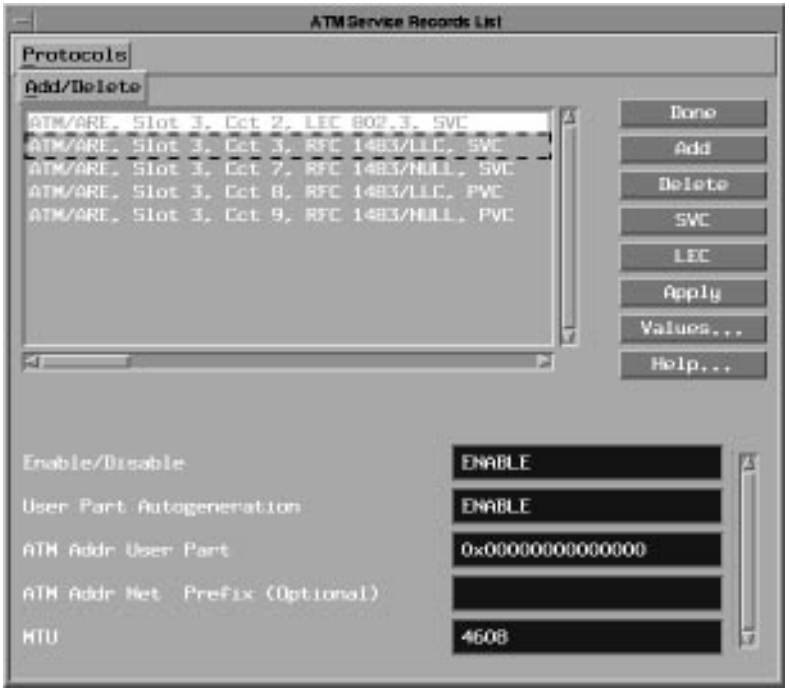
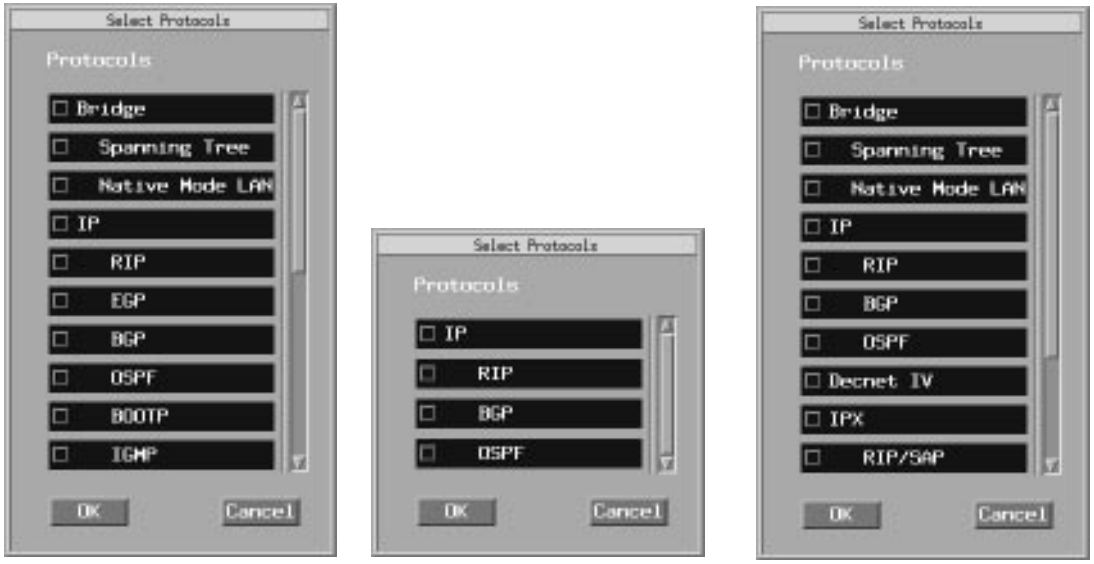


Figure 7-17. ATM Service Records List Window

2. **Click on the service record whose protocols you want to change.**
3. **Click on Protocols in the upper-left corner of the window.**

4. **Click on Add/Delete.**

   One of the following Select Protocols windows opens (Figure 7-18).



For PVCs | For SVCs Using LLC/SNAP or NULL | For SVCs Using LANE 802.3

Figure 7-18. Select Protocols Windows

5. **Select or deselect the bridging/routing protocols that you want to add or delete for that service record.**

6. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring protocols, the Configuration Manager returns you to the ATM Service Records List window.

   For each protocol you deselect, the Configuration Manager removes that protocol from the service record.

To edit an existing protocol:

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (refer to Figure 7-17).

2. **Click on the service record for which you want to edit protocols.**
3. **Click on Protocols in the upper-left corner of the window.**
4. **Click on the protocol that you want to edit.**

   The Configuration Manager displays protocol-specific windows where you can edit parameters. If you need assistance editing any parameters, consult the appropriate protocol-specific guide.

Note: *The Protocols menu provides multiple levels for some protocols, to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses Spanning Tree, you can bypass the upper-level bridging parameters and edit the Spanning Tree parameters directly (Figure 7-19).*

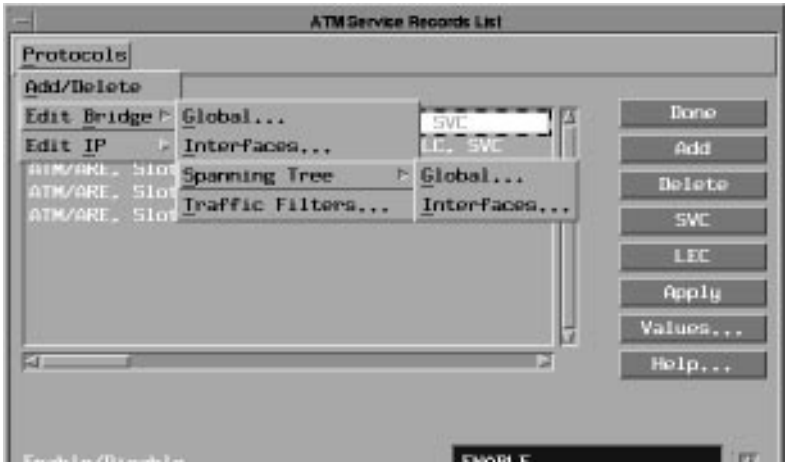


Figure 7-19. Protocols Menu (Multiple Levels)

Adding, Deleting, and Editing Bridging Protocols for Hybrid PVCs

After you designate a PVC as a hybrid/bridged VC, you can add, delete, or edit additional bridging protocols for that PVC.

Note: *Hybrid PVCs use the nonbridging protocols defined in the ATM Service Records List window.*

To add or delete a bridging protocol:

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 7-20).

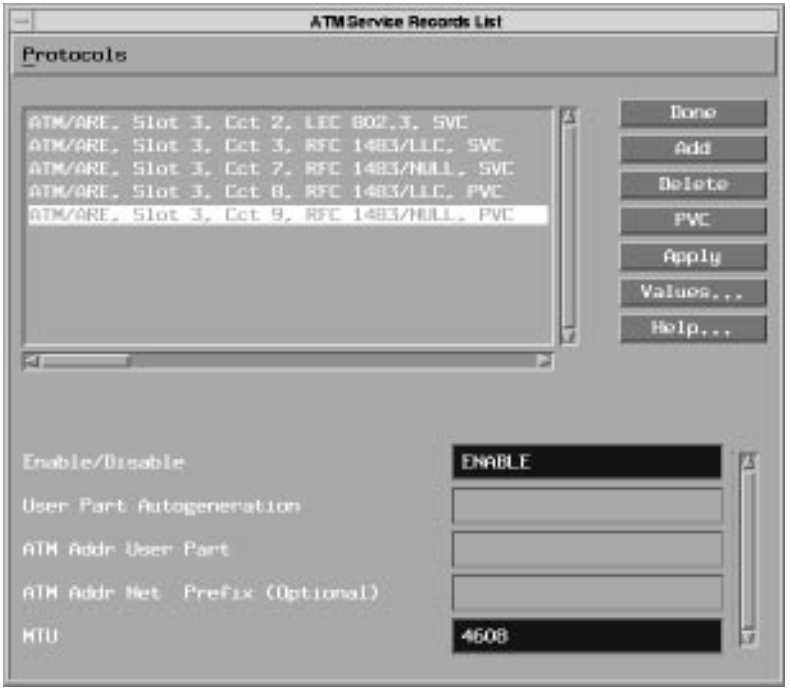


Figure 7-20. ATM Service Records List Window (PVC Selected)

2. **Click on the service record containing the hybrid access PVC for which you want to add or delete protocols.**

3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (Figure 7-21).

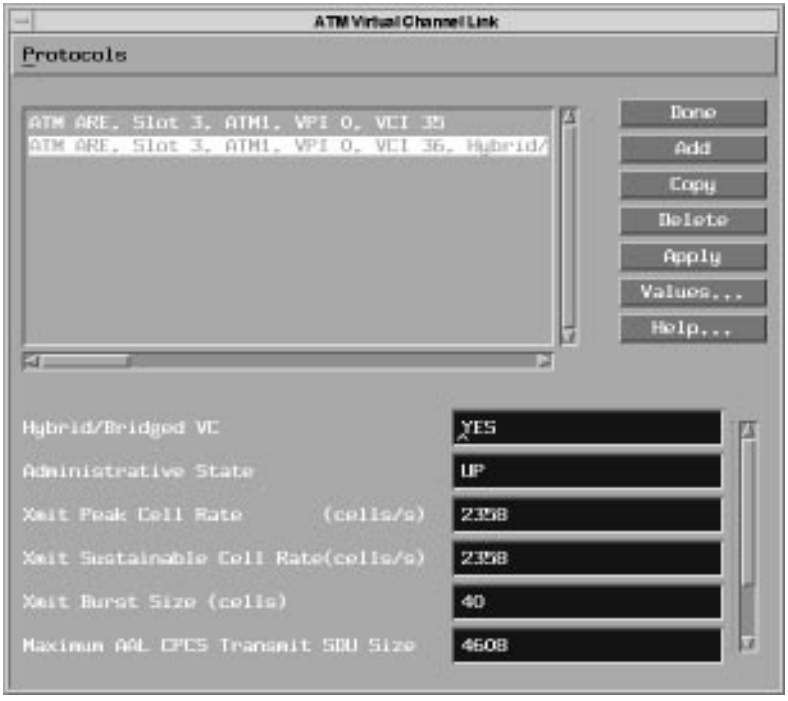


Figure 7-21. ATM Virtual Channel Link Window (Hybrid PVC)

4. **Click on a hybrid PVC.**

   The Protocols menu in the upper-left corner of the window becomes active.

5. **Click on Protocols.**

6. **Click on Add/Delete.**

   The Select Protocols window opens (Figure 7-22).

Figure 7-22. Select Protocols Window (Hybrid PVC)

7. **Select or deselect the bridging protocols that you want to add to or delete from the PVC.**
8. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring protocols, the Configuration Manager returns you to the ATM Service Records List window.

   For each protocol you deselect, the Configuration Manager removes that protocol from the hybrid PVC.

To edit an existing hybrid PVC protocol:

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (refer to Figure 7-20).

2. **Click on the service record containing the hybrid access PVC for which you want to edit protocols.**
3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (refer to Figure 7-21).

4. **Click on a hybrid PVC.**

   The Protocols menu in the upper-left corner of the window becomes active.

5. **Click on Protocols.**

6. **Click on the protocol that you want to edit.**

   The Configuration Manager displays protocol-specific windows where you can edit parameters. If you need assistance editing any parameters, consult the appropriate protocol-specific guide.

Note: *The Protocols menu provides multiple levels for some protocols, to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses Spanning Tree, you can bypass the upper-level bridging parameters and edit the Spanning Tree parameters directly (Figure 7-23).*

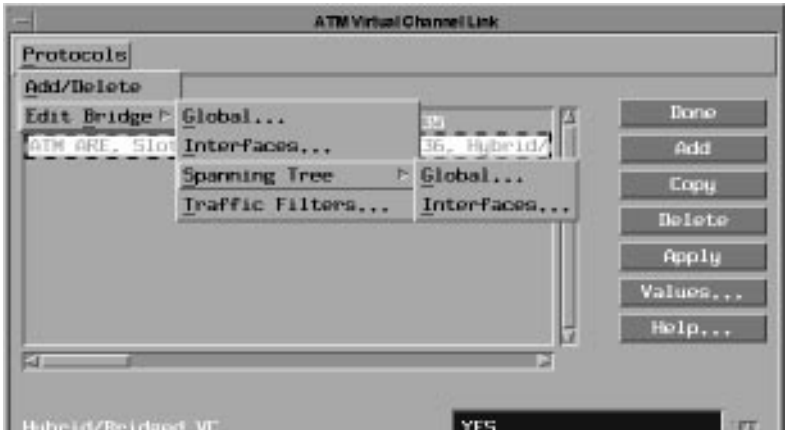


Figure 7-23. Protocols Menu (Multiple Levels)

Deleting Individual PVCs

To delete a PVC:

Caution: *Site Manager does not ask you to confirm your decision to delete a PVC. You cannot undo this action.*

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 7-24).

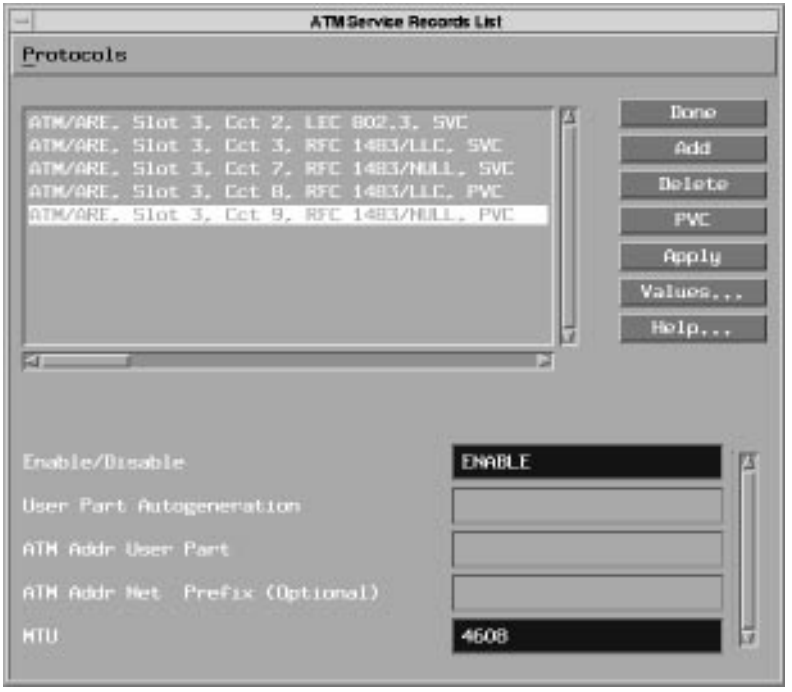


Figure 7-24. ATM Service Records List Window

2. **Click on the service record containing the PVC you want to delete.**

3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (Figure 7-25).

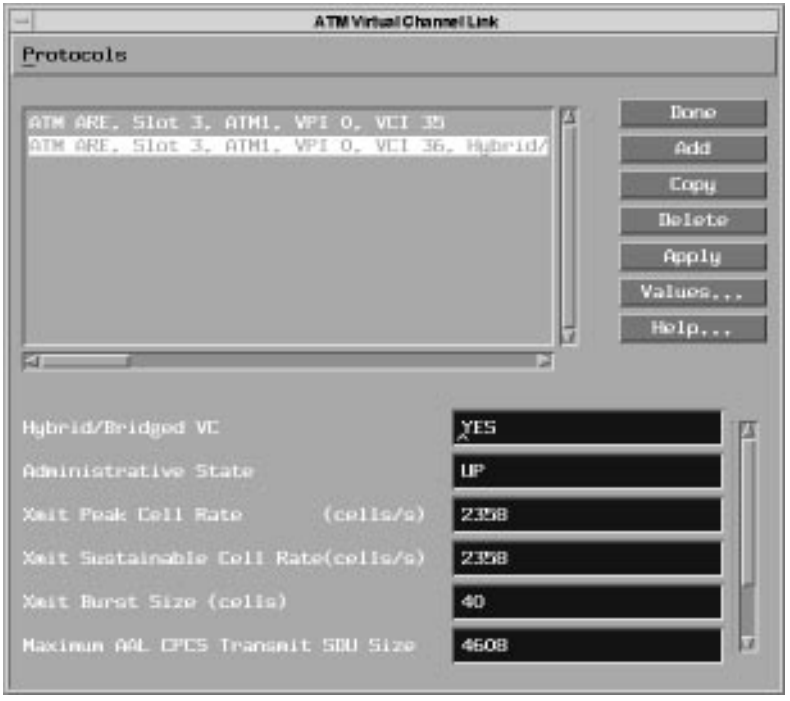


Figure 7-25. ATM Virtual Channel Link Window

4. **Click on the PVC you want to delete.**
5. **Click on Delete.**

   Site Manager deletes the PVC.

Deleting Individual SVCs

To delete an SVC:

Caution: *Site Manager does not ask you to confirm your decision to delete an SVC. You cannot undo this action.*

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 7-26).

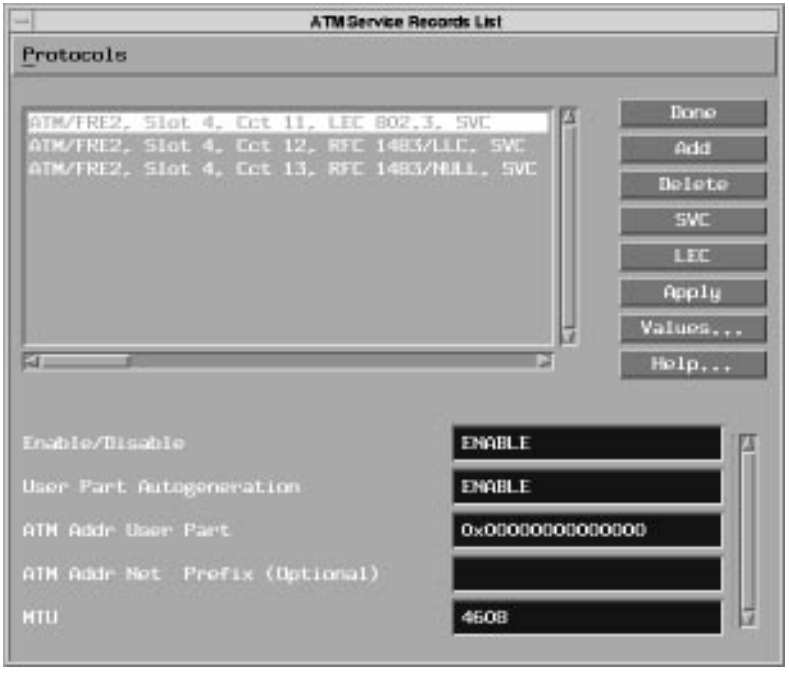


Figure 7-26. ATM Service Records List Window

2. **Click on the service record containing the SVC you want to delete.**

3. **Click on SVC.**

   The ATM Switched Virtual Circuit List window opens (Figure 7-27).

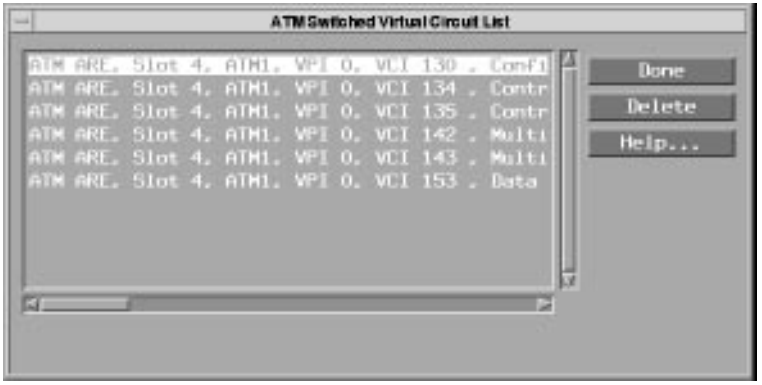

ATM Switched Virtual Circuit List
ATM ARE, Slot 4, ATM1, VPI 0, VCI 130 , Confi
ATM ARE, Slot 4, ATM1, VPI 0, VCI 134 , Contr
ATM ARE, Slot 4, ATM1, VPI 0, VCI 135 , Contr
ATM ARE, Slot 4, ATM1, VPI 0, VCI 142 , Multi
ATM ARE, Slot 4, ATM1, VPI 0, VCI 143 , Multi
ATM ARE, Slot 4, ATM1, VPI 0, VCI 153 , Data
Done
Delete
Help...

Figure 7-27. ATM Switched Virtual Circuit List Window

4. **Click on the SVC you want to delete.**
5. **Click on Delete.**

   Site Manager deletes the SVC.

Deleting an ATM Service Record

To delete an ATM service record:

Caution: *Site Manager does not ask you to confirm your decision to delete a service record. You cannot undo this action.*

1. **In the Edit ATM Connector window (refer to Figure 7-2), click on Service Attributes.**

   The ATM Service Records List window opens (refer to Figure 7-26).

2. **Click on the service record you want to delete.**
3. **Click on Delete.**

   Site Manager deletes the service record.

Deleting ATM from an Interface

To delete ATM from an interface:

1. **In the Configuration Manager window (refer to Figure 7-1), select the interface from which you want to delete ATM.**

   The Edit ATM Connector window opens (Figure 7-28).

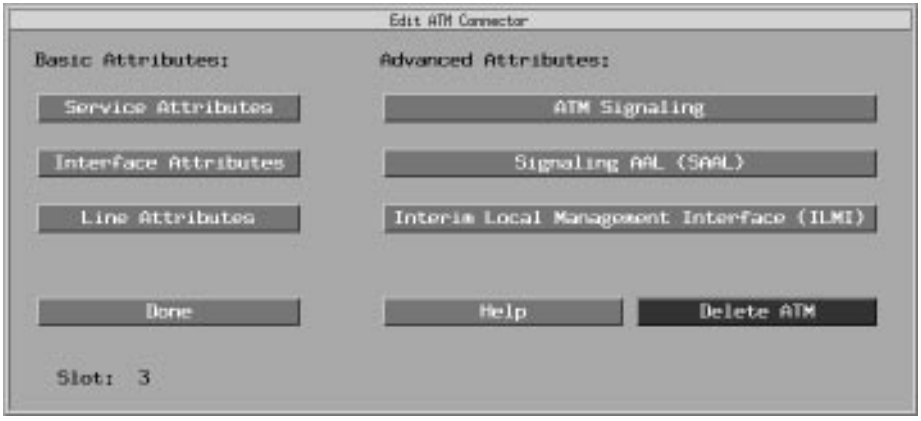


Figure 7-28. Edit ATM Connector Window

2. **Click on Delete ATM.**

   The Configuration Manager asks

   ```
   Do you REALLY want to delete ATM?
   ```

3. **Click on OK.**

   The Configuration Manager deletes ATM from that interface and returns you to the Configuration Manager window.

Deleting ATM from the Router

To delete ATM from the entire router:

1. **In the Configuration Manager window, select Protocols→ATM→Delete ATM (Figure 7-29).**

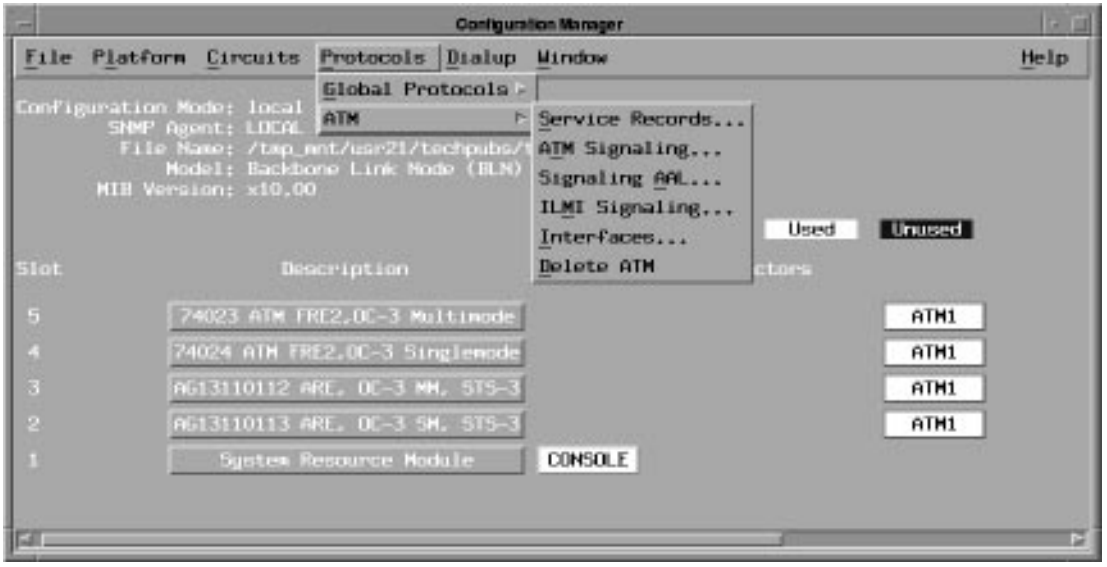


Figure 7-29. Deleting ATM from the Router

The Configuration Manager asks:

```
Do you REALLY want to delete ATM?
```

2. **Click on OK.**

Site Manager deletes ATM from the router and returns you to the Configuration Manager window.

Chapter 8
Editing ATM Service and Interface Parameters

Once you enable an ATM circuit, you can use the Configuration Manager to edit ATM service and interface parameters.

Note: *To edit ATM parameters, you must first enable ATM on the router. If you have not yet enabled an ATM interface, or if you want to enable additional ATM interfaces, go to Chapter 6 for instructions.*

For each ATM service or interface parameter, this chapter describes

- The default setting
- All valid parameter options
- The parameter function
- Instructions for setting the parameter
- The MIB object ID

Begin from the Edit ATM Connector window (Figure 8-1). For information about the Edit ATM Connector window, or how to access it, refer to Chapter 7.

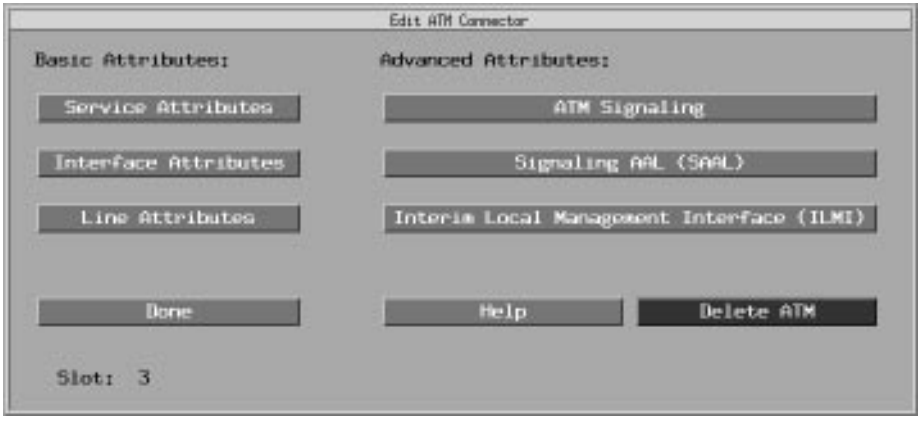


Figure 8-1. Edit ATM Connector Window

Editing Service Attributes

The service attributes define the ATM service records for an interface and any virtual circuits on those service records. You must manually add and configure all ATM service records for each interface and any permanent virtual circuits on each PVC-type service record. This section describes how to

- Add PVC or SVC service records
- Edit service record parameters
- Add or copy PVCs
- Edit PVC parameters
- Edit LAN emulation client parameters

Adding Service Records

The Configuration Manager allows you to add service records for a specific data encapsulation type. Depending on the data encapsulation type you choose, the Configuration Manager also allows you to select a PVC or SVC virtual connection type for that service record.

Table 8-1 identifies which data encapsulation types you can apply to permanent and switched virtual circuits.

Table 8-1. Valid Data Encapsulation Types for PVCs and SVCs

Data Encapsulation Type	Permanent Virtual Circuit	Switched Virtual Circuit
LANE 802.3		✔
LLC/SNAP	✔	✔
NULL	✔	✔

Note: *For an explanation of the different data encapsulation types and rules for assigning data encapsulation, refer to Chapter 7.*

Adding a Service Record for PVCs

To add a service record for permanent virtual circuits:

1. **Click on Service Attributes in the Edit ATM Connector window (refer to Figure 8-1).**

   The ATM Service Records List window opens (Figure 8-2).

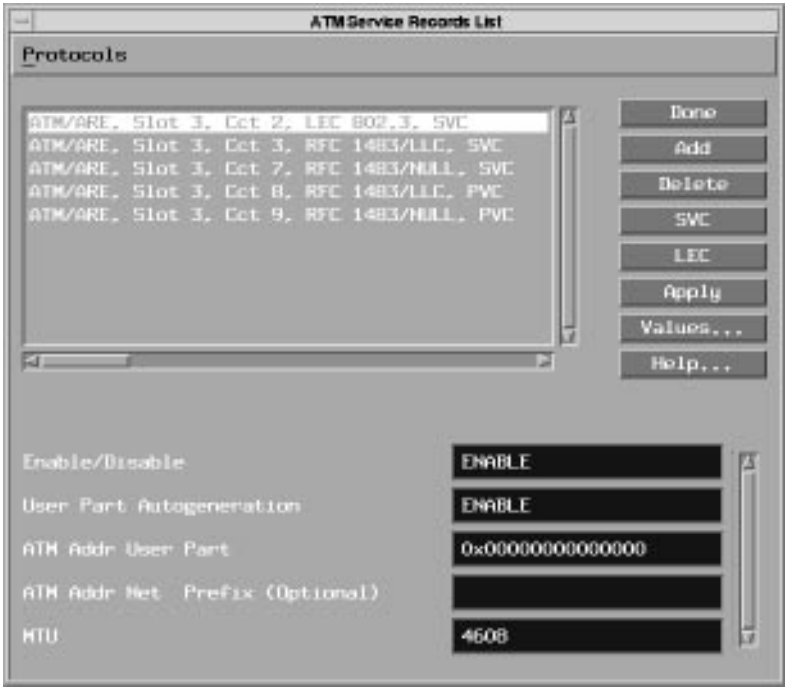


Figure 8-2. ATM Service Records List Window

2. **Click on Add.**

   The ATM Service Record Parameters window opens (Figure 8-3).

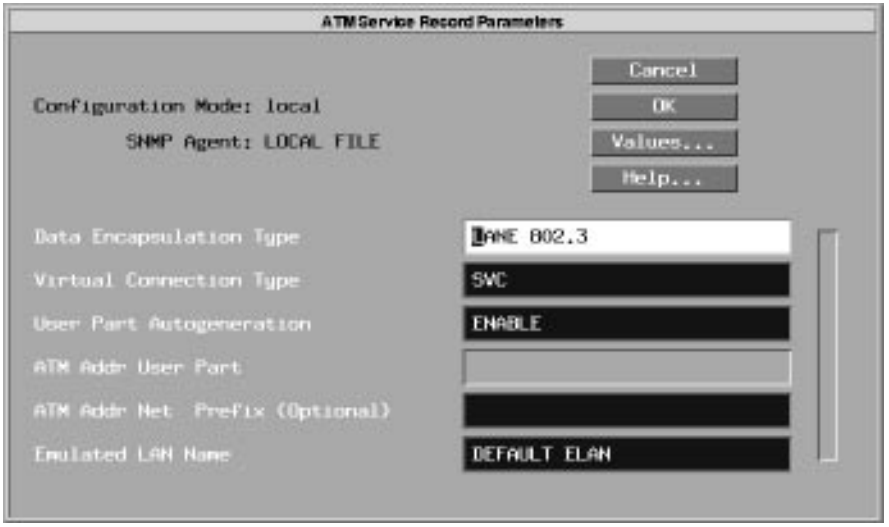


Figure 8-3. ATM Service Record Parameters Window

3. **Change the Data Encapsulation Type parameter from LANE 802.3 (the default) to NULL or LLC/SNAP.**

4. **Change the Virtual Connection Type parameter from SVC to PVC.**

   If you want to change any other parameters in the ATM Service Record Parameters window, refer to “ATM Service Record Parameter Descriptions” later in this chapter for instructions.

5. **Click on OK.**

   The Select Protocols window opens (Figure 8-4).

Figure 8-4. Select Protocols Window (PVCs)

6. **Click on the protocols you want to enable.**
7. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the ATM Virtual Channel Link window opens (Figure 8-6). Each PVC-type service record must contain at least one PVC to function on a network.

8. **Go to "Adding or Copying PVCs," later in this chapter, for instructions on how to add or copy a PVC.**

Adding a Service Record for SVCs

To add a service record for switched virtual circuits:

1. **Click on Service Attributes in the Edit ATM Connector window (refer to Figure 8-1).**

   The ATM Service Records List window opens (refer to Figure 8-2).

2. **Click on Add.**

   The ATM Service Record Parameters window opens (refer to Figure 8-3). If you want to change any of the parameters in the ATM Service Record Parameters window, refer to "ATM Service Record Parameter Descriptions," later in this chapter, for instructions.

3. **Click on OK.**

   The Select Protocols window opens.

Note: *The contents of the Select Protocols window vary, depending on the data encapsulation type you set in the ATM Service Record Parameters window. Refer to "Assigning Data Encapsulation" in Chapter 7 for additional information.*

4. **Click on the protocols you want to enable.**

5. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns you to the ATM Service Records List window.

Editing ATM Service Record Parameters

To edit service record parameters:

Note: *You must add or copy a PVC to a service record before you can edit it. Refer to "Adding or Copying PVCs," later in this chapter, for details.*

1. **In the Edit ATM Connector window (refer to Figure 8-1), click on Service Attributes.**

   The ATM Service Records List window opens (refer to Figure 8-2).

2. **Click on the service record that you want to edit.**
3. **Assign new values to the service record parameters you want to edit.**

   Refer to the next section for guidelines.

4. **Click on Apply.**

ATM Service Record Parameter Descriptions

Use the following descriptions when editing the parameters in the ATM Service Record Parameters and the ATM Service Records List windows.

Parameter:	**Enable/Disable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables this service record.
Instructions:	Accept the default, Enable, if you want traffic to flow on this service record and its VCs. Set to Disable if you do not want traffic to flow on this service record or any of its VCs.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.2

Parameter: **Data Encapsulation Type**

Default: LANE 802.3 (signaling enabled) or LLC/SNAP (signaling disabled)

Options: LANE 802.3 | LLC/SNAP | NULL

Function: Identifies the data encapsulation type for this service record.

You can use this parameter to select

- LLC/SNAP or NULL data encapsulation for service records containing PVCs
- LLC/SNAP data encapsulation for service records containing hybrid PVCs
- LANE 802.3 for service records containing SVCs over which you want to run LAN emulation
- LLC/SNAP or NULL for service records containing SVCs over which you want to run classical IP (RFC 1577)

If you select NULL, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.

Instructions: Select a data encapsulation type.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.2.1.5

Parameter: **Virtual Connection Type**

Default: SVC (signaling enabled) or PVC (signaling disabled)

Options: PVC | SVC

Function: Identifies the virtual connection type of this service record.

Instructions: Accept the default, SVC, if you want the service record to contain switched virtual circuits. Select PVC if you want the service record to contain permanent virtual circuits.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.2.1.7

Parameter:	**User Part Autogeneration**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables autogeneration of the ATM Address User Part (see the next parameter). Depending on the settings in the ATM Interface Attributes window, the ATM Address User Part contains either the hardware MAC address or a MAC address override value.
Instructions:	Accept the default, Enable, if you want the Configuration Manager to automatically generate the ATM Address User Part for any SVC service record that you add to this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.11

Parameter:	**ATM Addr User Part**
Default:	None
Range:	00000000000000 to FEFFFFFFFFFFFF
Function:	Defines the User Part (suffix) of the ATM address for this service record. The user part suffix consists of a 6-byte endstation identifier and a 1-byte selector field. The Configuration Manager allows you to autogenerate this parameter (see the User Part Autogeneration parameter). Depending on the settings in the ATM Interface Attributes window, this parameter can autogenerate this address using • The 6-byte hardware MAC address of the ATM interface • A MAC address override value that you specify In both cases, autogeneration creates a unique selector byte for each service record on the interface.
Instructions:	Enter a value in the range specified.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.9

Parameter:	**ATM Addr Net Prefix (Optional)**
Default:	None
Range:	XX00000000000000000000000 to XXFFFFFFFFFFFFFFFFFFFFFFF where XX = 39, 45, or 47
Function:	Defines the Network Prefix of the ATM address for this service record. The network prefix specifies the ATM domain of which this service record is a part. The XX byte must contain 39, 45, or 47. These values define the Authority and Format Identifier (AFI). The AFI byte identifies the group responsible for allocating the prefix and the format the prefix uses. For more information about the AFI byte, refer to the ATM Forum UNI specification (Version 3.0).
Instructions:	Setting this parameter is optional. If you do not enter an ATM Address Network Prefix in the range specified above, the service record accepts the first prefix value that it receives from the switch.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.8

Parameter:	**Emulated LAN Name**
Default:	Default ELAN
Options:	Leave blank or enter up to 128 alphanumeric characters
Function:	Identifies the name of the emulated LAN that this LE client joins when it joins an emulated LAN. Clients that use Automatic configuration mode use this parameter in their LE_CONFIGURE_REQUEST frames. Clients that use Manual configuration mode use this parameter in their LE_JOIN_REQUEST frames. Entering an ELAN name is optional. However, if you do not enter an ELAN name, the LAN emulation client server (LECS) assigns the LE client to an ELAN for this domain.
Instructions:	Either leave this parameter blank or enter an ELAN name (up to 128 alphanumeric characters) that identifies the emulated LAN you want this client to join.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.8

Parameter:	**MTU**
Default:	4608
Range:	0 to 9188
Function:	Defines the Maximum Transmission Unit (MTU), in bytes, that this service record can send. The MTU size is typically determined by the driver. However, this parameter allows you to override the driver default to accommodate connection to devices that require different MTU sizes.
Instructions:	Accept the default or enter an MTU size for this service record.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.12

Note: *For full compatibility with RFC 1577, you may have to specify an MTU size of 9188 bytes.*

Adding or Copying PVCs

Whether you add or copy a PVC, you can always change its configuration later.

Adding a PVC

To add a new PVC:

1. **In the Edit ATM Connector window (refer to Figure 8-1), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 8-5).

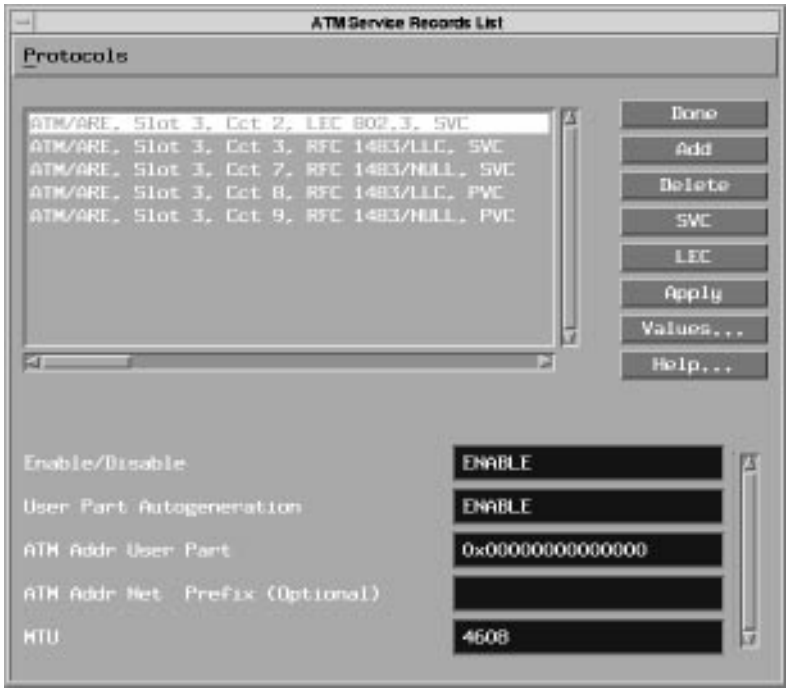


Figure 8-5. ATM Service Records List Window

2. **Click on the service record to which you want to add a PVC.**

3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (Figure 8-6).

Figure 8-6. ATM Virtual Channel Link Window

4. **Click on Add.**

   The ATM Virtual Channel Link Parameters window opens (Figure 8-7).

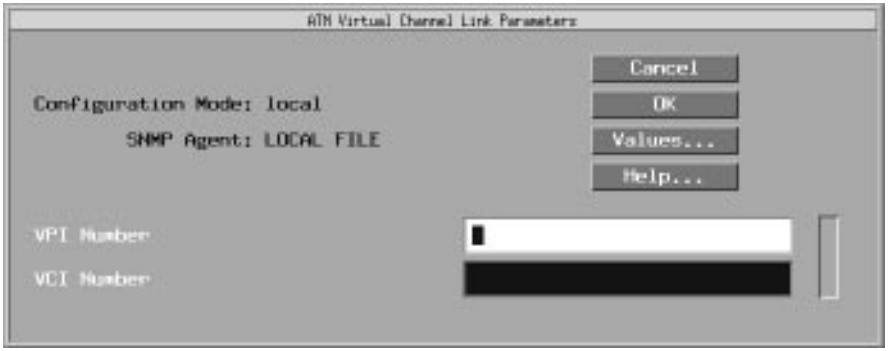


Figure 8-7. ATM Virtual Channel Link Parameters Window

5. **Enter the VPI and VCI numbers that you want to use for the PVC.**

   Refer to "ATM Virtual Channel Link Parameter Descriptions," later in this chapter, for guidelines.

6. **Click on OK.**

   The Configuration Manager returns you to the ATM Virtual Channel Link window. The window displays the default parameter values for this PVC.

   If you want to change the default configuration, complete the procedure described in the section "Editing Virtual Channel Link Parameters."

Copying a PVC

To copy an existing PVC:

1. **In the Edit ATM Connector window (refer to Figure 8-1), click on Service Attributes.**

   The ATM Service Records List window opens (refer to Figure 8-5).

2. **Click on the service record that contains the PVC you want to copy.**

3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (refer to Figure 8-6).

4. **Click on the PVC you want to copy.**

5. **Click on Copy.**

   The ATM Virtual Channel Link Parameters window opens (refer to Figure 8-7).

6. **Enter the VPI and VCI numbers that you want to use for the PVC.**

   Refer to the following section for guidelines.

7. **Click on OK.**

   The Configuration Manager returns you to the ATM Virtual Channel Link window. The window displays the default parameter values for this PVC.

   If you want to change the default configuration, complete the procedure described in the section “Editing Virtual Channel Link Parameters.”

Caution: *When copying a hybrid PVC, the copy function copies all existing PVC-specific information to the new PVC. However, this function does not copy the protocols that you selected and configured for that PVC. You must select and configure any desired protocols for the newly copied PVC.*

ATM Virtual Channel Link Parameter Descriptions

Use the following descriptions when setting the parameters in the ATM Virtual Channel Link Parameters window.

Note: *ATM does not allow duplicate VPI/VCI pairs on the same physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, on different link modules).*

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the PVC. The VPI is part of the cell header. The header can contain a maximum of 8 VPI bits for a UNI connection. This bit range allows for path identifiers from 0 to 255.
Instructions:	Enter a value from 0 to 255.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.3

Parameter:	**VCI Number**
Default:	None
Range:	32 to 65535
Function:	Identifies the virtual channel of the PVC. The VCI is part of the cell header. The header can contain a maximum of 16 VCI bits. This bit range allows for path identifiers from 0 to 65535.
Instructions:	Enter a value from 32 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.4

Note: *Following the recommendation of the ATM Forum, virtual channel identifiers from 0 to 31 are reserved for signaling and added functionality.*

Editing PVC Parameters

To edit PVC parameters:

Note: *You must add or copy a PVC to a service record before you can edit it. Refer to "Adding or Copying PVCs," earlier in this chapter.*

1. **In the Edit ATM Connector window (refer to Figure 8-1), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 8-8).

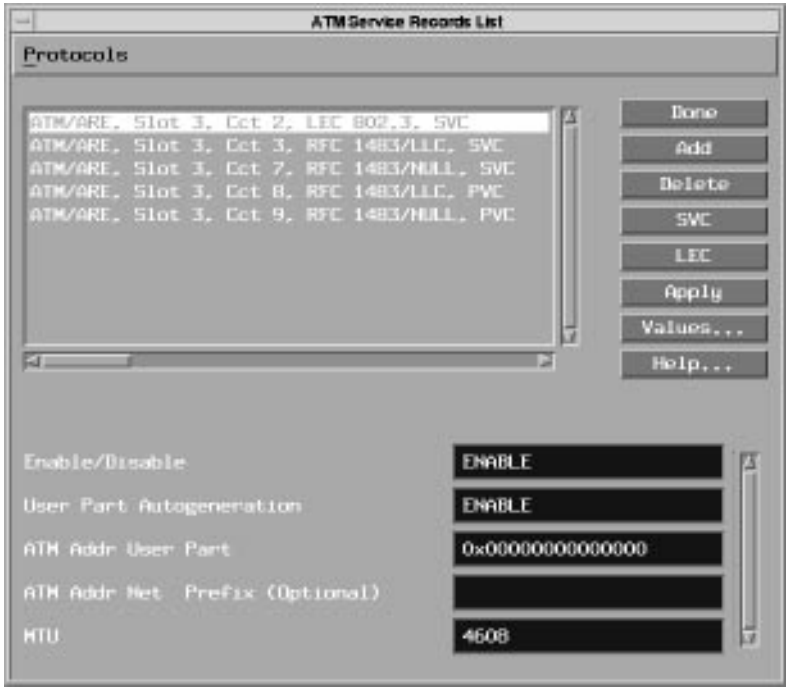


Figure 8-8. ATM Service Records List Window

2. **Click on the service record that contains the PVC you want to edit.**

3. **Click on PVC.**

   The ATM Virtual Channel Link window opens (Figure 8-9).

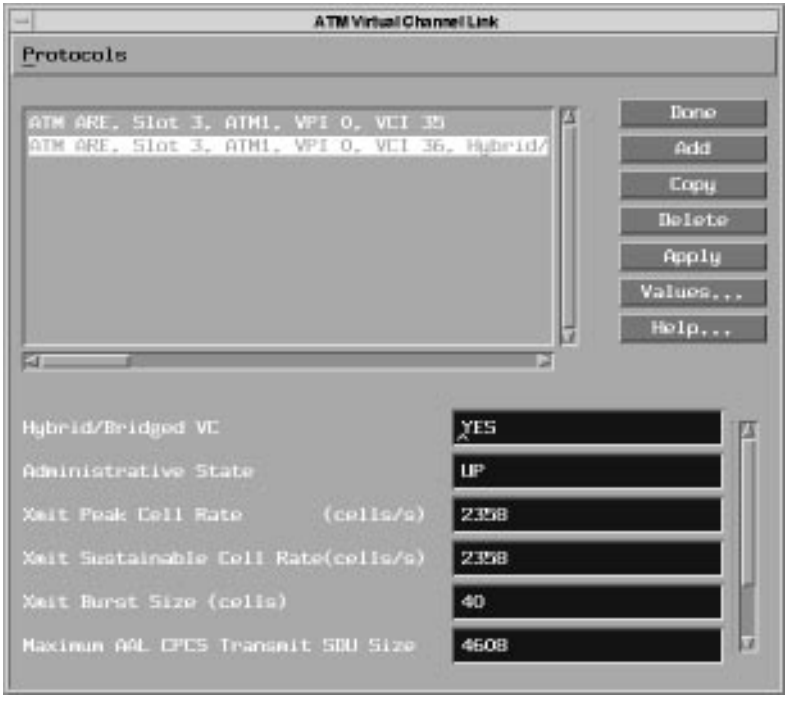


Figure 8-9. ATM Virtual Channel Link Window

4. **Select the PVC you want to edit.**
5. **Assign new values to the PVC configuration parameters.**

   Refer to the following section for guidelines.

6. **Click on Apply.**

   If you set the Hybrid/Bridged VC parameter to No (the default; that is, you do not want the PVC to operate as a hybrid VC), the Configuration Manager saves your changes. You have completed the procedure.

If you set the Hybrid/Bridged VC parameter to Yes, the Configuration Manager adds a Protocols menu option to the top left corner of the ATM Virtual Channel Link window and then displays the Select Protocols window (Figure 8-10).

Note: *If you configure the PVC to operate as a hybrid/bridged VC, only Bridge, Spanning Tree, and Native Mode LAN appear as options in the Select Protocols window. To detect loops in the network, we strongly recommend that you enable spanning tree on all hybrid access PVCs.*

Figure 8-10. Select Protocols Window (Hybrid)

7. **Select the protocols you want the hybrid PVC to carry.**
8. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish selecting protocols, the Configuration Manager returns you to the ATM Virtual Channel Link window.

Note: *The Configuration Manager initially assigns LLC/SNAP to any new hybrid access mode PVC. In other words, even if you set a service record to use NULL, the Configuration Manager sets each new hybrid PVC to the MIB default of LLC/SNAP. To change the encapsulation type for a hybrid PVC, you must assign the value directly to the hybrid PVC in the ATM Virtual Channel Link window.*

ATM Virtual Channel Link Parameter Descriptions

Use the following descriptions when you set the parameters in the ATM Virtual Channel Link window.

Parameter:	**Hybrid/Bridged VC**
Default:	No
Options:	Yes | No
Function:	Specifies whether the VC is set to hybrid access mode.
Instructions:	Accept the default, No, if you want the VC to work in group access mode only. Set to Yes if you want the VC to operate as a hybrid VC. For more information about the group and hybrid access modes, refer to "PVC Access Methods" in Chapter 5.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.25

Parameter:	**Administrative State**
Default:	Up
Options:	Up | Down
Function:	Specifies the administrative state of the PVC. The Up state indicates that traffic flow is enabled on this PVC. The Down state indicates that traffic flow is disabled on this PVC.
Instructions:	Accept the default, Up, if you want traffic to flow on this PVC. Set the state to Down if you do not want traffic to flow on this PVC.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.5

Parameter:	**Xmit Peak Cell Rate (cells/s)**
Default:	2358
Range:	300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs) 128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs) 128 to 96000 (ATM ARE DS-3 ILI pairs) 128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode) 128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)
Function:	Specifies the upper traffic limit, in cells/s, that the ATM connection can submit. How you set the peak cell rate depends on • The optical transmission rate of your ATM device • The amount of traffic you expect on a particular VC • The rate you desire for each VC
Instructions:	After you determine the transmission rate of your ATM device, set the peak cell rate within the range specified above.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.8

Parameter: **Xmit Sustainable Cell Rate (cells/s)**

Default: 2358

Range: 300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs)
0, 128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs)
0, 128 to 96000 (ATM ARE DS-3 ILI pairs)
0, 128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode)
0, 128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)

Function: Specifies the upper limit of the ATM connection conforming average rate. The average rate equals the total number of cells transmitted divided by the duration of the connection.

Using the sustainable cell rate (SCR), you can define the future cell flow of a VC in greater detail than by just using the peak cell rate.

For ATM FRE2 ILI pairs, specifying the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources.

For ATM ARE ILI pairs, the SCR maps directly to the minimum cell rate (MCR). The MCR defines the minimum amount of guaranteed bandwidth allowed for PVCs and Control VCs on the ATM line.

When setting the SCR for ATM FRE2 ILI pairs, keep the following in mind:

- The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VC to conform.
- To be useful, the SCR must not exceed the PCR.
- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM FRE2 ILI pairs require a minimum SCR value of 300 cells/s. PVCs may fail to operate with SCR values less than 300 cells/s.

When setting the SCR for ATM ARE ILI pairs, keep the following in mind:

- The SCR maps directly to the MCR.
- The MCR provides guaranteed bandwidth for PVCs and Control VCs while allowing sufficient bandwidth for SVCs to operate.
- To be useful, the SCR must not exceed the PCR.

- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM ARE ILI pairs require a minimum SCR value of 128 cells/s. VCs may fail to operate with SCR values less than 128 cells/s.
- ATM ARE ILI pairs allow you to enter an SCR value of 0. Entering 0 for the SCR turns off this function.
- The E-3 framing mode setting affects the maximum SCR.

Instructions: After you determine the transmission rate of your ATM device, set the sustainable cell rate within the range specified above. For ATM ARE ILI pairs, you can enter 0 to turn off this function.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.9

Parameter: **Xmit Burst Size (cells)**

Default: 40

Range: 1 to 65535

Function: For ATM FRE2 ILI pairs, the Maximum Burst Size is the maximum length of a cell stream on a particular VC. The MBS specifies the maximum number of sequential cells allowed on a VC, at the peak cell rate, before the VC must relinquish bandwidth to other VCs.

When setting the MBS, we suggest that you select a value larger than the largest packet your PVC or Control VC can transmit (that is, the Maximum AAL CPCS Transmit SDU size). For example, if your VC accepts packets that are less than 2358 bytes long (PVC default), set your MBS value between 45 and 50 cells.

Instructions: Set a value in the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.10

Note: *ATM ARE ILI pairs ignore the maximum burst size.*

Parameter:	**Maximum AAL CPCS Transmit SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the transmit direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to transmit. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.17

Parameter:	**Maximum AAL CPCS Receive SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the receive direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to receive. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.18

Parameter:	**Data Encapsulation Type**
Default:	LLC/SNAP
Options:	LLC/SNAP | NULL
Function:	Specifies the type of data encapsulation used over AAL 5 SSCS layers. Use this parameter to select LLC/SNAP or NULL data encapsulation for • All PVCs on a particular service record • Hybrid PVCs
Instructions:	We recommend selecting LLC/SNAP. If you select NULL, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.19

Editing LAN Emulation Client Parameters

Before you can edit LAN emulation client parameters, you must create an SVC service record using LANE 802.3 data encapsulation. Refer to “Adding Service Records,” earlier in this chapter, for details.

For an overview of ATM LAN emulation, refer to Appendix B.

To edit LAN emulation parameters:

1. **In the Edit ATM Connector window (refer to Figure 8-1), click on Service Attributes.**

   The ATM Service Records List window opens (Figure 8-11).

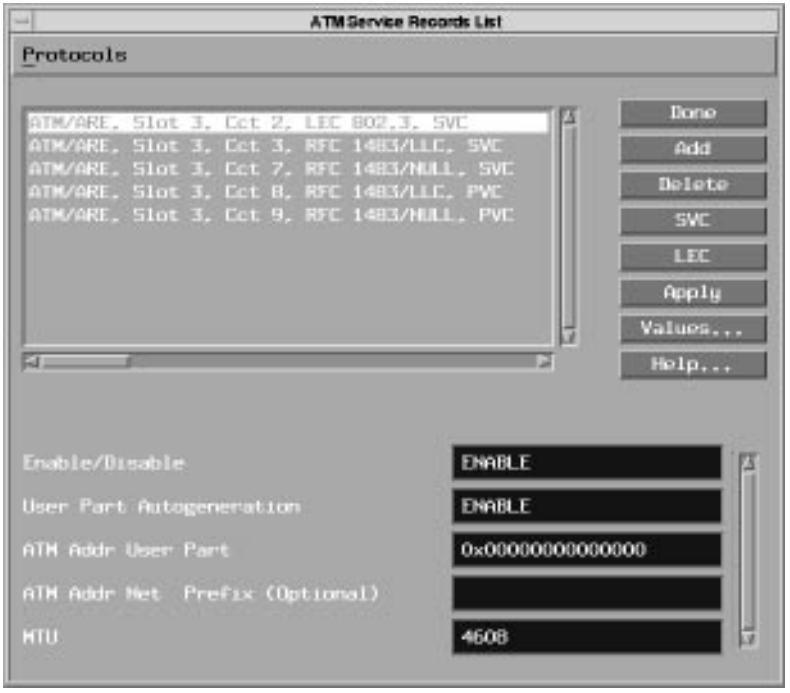


Figure 8-11. ATM Service Records List Window

2. **Click on the LAN emulation service record that you want to edit.**

3. **Click on LEC.**

   The LAN Emulation Parameters window opens (Figure 8-12).

Figure 8-12. LAN Emulation Parameters Window

4. **Assign new values to the service record configuration parameters you want to edit.**

   Refer to the next section for guidelines.

5. **Click on OK.**

   The Configuration Manager updates the LAN emulation parameters and returns you to the ATM Service Records List window.

LAN Emulation Parameter Descriptions

Use the following descriptions when you set the parameters in the LAN Emulation Parameters window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables LAN emulation on this service record.
Instructions:	Accept the default, Enable, if you want LAN emulation to remain enabled on this service record. Select Disable if you do not want LAN emulation enabled on this service record.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.2

Parameter:	**Owner**
Default:	None
Options:	Leave blank or enter up to 128 alphanumeric characters
Function:	Identifies this LAN emulation client. This parameter is optional.
Instructions:	Either leave this parameter blank or enter a text string (up to 128 alphanumeric characters) to identify this LAN emulation client.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.4

Parameter:	**Configuration Mode**
Default:	Automatic
Options:	Automatic | Manual
Function:	Indicates whether this LAN emulation client configures automatically (that is, uses information from the LECS) or manually (that is, uses information from the LAN Emulation Parameters window).
Instructions:	Accept the default, Automatic, if you want this client to configure automatically. Select Manual if you do not want the router to auto-configure.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.5

Parameter:	**LEC LAN Type**
Default:	Unspecified
Options:	Unspecified | IEEE8023
Function:	Indicates the data frame format this client uses when it joins an emulated LAN. Clients that use Automatic configuration mode use this parameter in their LE_CONFIGURE_REQUEST frames. Clients that use Manual configuration mode use this parameter in their LE_JOIN_REQUEST frames. Selecting manual configuration mode (refer to the parameter description above) automatically sets the LEC LAN Type to the 802.3 option.
Instructions:	Accept the default, Unspecified, if you want the client to obtain the LAN type from the LAN emulation configuration server (LECS) when it joins an emulated LAN. Select IEEE8023 if you want the client to join only Ethernet emulated LANs.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.6

Note: *Bay Networks routers currently support only Ethernet IEEE 802.3 emulated LAN connectivity. When accepting the default, Unspecified, ensure that the LECS supplies a configuration for an IEEE 802.3 emulated LAN.*

Parameter: **Maximum Data Frame Size**

Default: Unspecified

Options: Unspecified | 1516

Function: Defines the maximum data frame size (in octets) that this client uses when it joins an emulated LAN. Clients that use Automatic configuration mode use this parameter in their LE_CONFIGURE_REQUEST frames. Clients that use Manual configuration mode use this parameter in their LE_JOIN_REQUEST frames.

Selecting Manual configuration mode automatically sets the Maximum Data Frame Size to 1516.

Instructions: Accept the default, Unspecified, if you want the client to obtain the maximum data frame size when it joins an emulated LAN. Select 1516 if you want to designate the maximum data frame size that this client can

- Send on the Multicast Send VCC
- Receive on the Multicast Forward VCC
- Send and receive on Data Direct VCCs

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.20.1.1.7

Parameter: **ELAN Name**

Default: Default ELAN

Options: Leave blank or enter up to 128 alphanumeric characters.

Function: Identifies the name of the emulated LAN that this LE client joins when it joins an emulated LAN. Clients that use Automatic configuration mode use this parameter in their LE_CONFIGURE_REQUEST frames. Clients that use Manual configuration mode use this parameter in their LE_JOIN_REQUEST frames.

Entering an ELAN name is optional. However, if you do not enter an ELAN name, the LAN emulation client server (LECS) assigns the LE client to an ELAN for this domain.

Instructions: Either leave this parameter blank or enter an ELAN name (up to 128 alphanumeric characters) that identifies the emulated LAN you want this client to join.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.20.1.1.8

Parameter:	**LE Server ATM Address**
Default:	None
Options:	Any valid ATM address
Function:	Defines the LAN emulation server that this client uses when it starts. The client uses the LAN emulation server to establish the Control Direct VCC. You do not have to set this address when using Automatic configuration mode.
Instructions:	If you select Manual configuration mode, enter the address of the LAN emulation server. If you select Automatic configuration mode, you do not have to enter this address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.9

Parameter:	**Control Timeout**
Default:	5
Range:	5 to 32767
Function:	Defines the timeout period used for timing out most request/response control frame interactions.
Instructions:	Accept the default, 5, or enter a value from 5 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.10

Parameter:	**Max Unknown Frame Count**
Default:	1
Range:	1 to 10
Function:	Defines the maximum number of unknown frames an LE client can send within the interval specified with the Max Unknown Frame Time parameter. A frame is considered unknown when the LE client does not recognize the destination MAC address. In this case, the unknown frame goes to the BUS for distribution. This parameter helps to limit unknown frame traffic to the BUS.
Instructions:	Accept the default, 1, or enter a value from 1 to 10.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.11

Parameter:	**Max Unknown Frame Time**
Default:	1
Range:	1 to 60
Function:	Defines the Maximum Unknown Frame Time value (in seconds). This value specifies the maximum amount of time allowed to send the number of unknown frames specified with the Max Unknown Frame Count parameter. For example, if you use the defaults for these parameters, a LAN emulation client can send up to one unknown frame within 1 second for any given MAC address, without having to initiate the address resolution protocol to resolve that MAC address. This parameter helps to limit unknown frame traffic to the broadcast and unknown server (BUS).
Instructions:	Accept the default, 1, or enter a value from 1 to 60.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.12

Parameter:	**VCC Timeout Period Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Defines the state of the virtual channel connection (VCC) timeout period. When you enable this parameter, a LAN emulation client may release any unused Data Direct or Multicast Send VCCs after the VCC timeout period expires. The ATM drivers provide a timeout period of 20 minutes.
Instructions:	Accept the default, Enable, if you want this LAN emulation client to release unused Data Direct VCCs after the VCC timeout period expires. Select Disable if you do not want this LAN emulation client to release unused Data Direct VCCs after the VCC timeout period expires.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.13

Parameter:	**Max Retry Count**
Default:	1
Range:	1 to 2
Function:	Defines the maximum number of times a LAN emulation client can retry an LE_ARP_REQUEST (following the original request) for a given frame MAC address.
Instructions:	Accept the default, 1, or enter 2 as the new value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.14

Parameter:	**Aging Time**
Default:	300
Range:	10 to 300
Function:	Defines the maximum amount of time (in seconds) that a LAN emulation client can maintain an entry in its LAN emulation ARP cache without verifying the relationship of that entry.
Instructions:	Accept the default, 300, or enter a value from 10 to 300.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.15

Parameter:	**Forward Delay Time**
Default:	15
Range:	4 to 30
Function:	While there are no changes occurring in network topology, this parameter defines the maximum amount of time (in seconds) that a LAN emulation client can maintain an entry in its LAN emulation ARP cache without verifying the relationship of that entry.
Instructions:	Accept the default, 15, or enter a value from 4 to 30.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.16

Parameter:	**Expected LE_ARP Response Time**
Default:	3
Range:	1 to 30
Function:	Defines the amount of time (in seconds) that the LAN emulation client expects an ARP request and ARP response cycle to take. The LAN emulation client uses this value during retries and verifications.
Instructions:	Accept the default, 3, or enter a value from 1 to 30.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.17

Parameter:	**Flush Timeout**
Default:	4
Range:	1 to 4
Function:	Defines the amount of time (in seconds) that the LAN emulation client waits to receive a flush response (after sending a flush request) before it takes recovery action by switching back to the BUS.
Instructions:	Accept the default, 4, or enter a value from 1 to 4.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.18

Parameter:	**Path Switching Delay**
Default:	6
Range:	1 to 8
Function:	Defines the amount of time (in seconds) that the LAN emulation client waits after sending a frame over an old VCC before it switches to a new VCC (this applies to multicast and data direct VCCs). You can use this parameter to bypass the Flush protocol (that is, when you disable the Flush Protocol parameter, the data for a specific MAC address automatically begins flowing over a new VC when the Path Switching Delay time elapses).
Instructions:	Accept the default, 6, or enter a value from 1 to 8.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.20.1.1.19

Parameter: **Flush Protocol**

Default: Enable

Options: Enable | Disable

Function: Enables or disables the flush protocol on this LE client.

The flush protocol ensures that data destined for a particular MAC address arrives in sequence. When enabled, the flush protocol drops cells with this MAC address while waiting for

- The flush response for that MAC address
- The flush timeout to expire for that MAC address

If the client receives a flush response for the cell MAC address, the cells for this MAC address begin flowing over a new virtual circuit. However, if the flush timeout expires for this MAC address, the cells begin flowing to the broadcast and unknown server (BUS).

When disabled, cells containing the same MAC address are dropped while waiting for the Path Switching Delay parameter to time out. After the Path Switching Delay time elapses, the data automatically begins flowing over a new virtual circuit.

Instructions: Accept the default, Enable, if you want the flush protocol to operate on this LAN emulation client. Select Disable if you do not want the flush protocol to operate on this LAN emulation client.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.20.1.1.25

Parameter: **LE Config Server ATM Address**

Default: None

Options: Any valid LAN emulation configuration server (LECS) ATM address

Function: Defines the LECS ATM address. Entering an address for this parameter is optional. If you do not enter an address, the LE client uses the well-known LECS ATM address to open a configuration VCC to the configuration service.

Instructions: Leave blank or enter the ATM address of the LAN emulation configuration server.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.20.1.1.30

Editing ATM Interface Attributes

The ATM interface attributes define the up or down state of the ATM interface and whether ATM signaling is enabled. You edit the interface attributes from the ATM Interface Attributes window (Figure 8-13).

To access this window, click on Interface Attributes in the Edit ATM Connector window (refer to Figure 8-1).

Figure 8-13. ATM Interface Attributes Window

ATM Interface Parameter Descriptions

Use the following descriptions when you set the parameters in the ATM Interface Attributes window.

Parameter:	**Administrative State**
Default:	Up
Options:	Up | Down
Function:	Specifies whether this interface is enabled or disabled.
Instructions:	Accept the default, Up, if you want traffic to flow over this interface. Set the state to Down if you do not want traffic to flow over this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.1.1.3

Parameter:	**Enable ATM Signaling**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies whether ATM signaling is enabled or disabled for this interface. Signaling allows you to configure switched features (for example, SVCs and LAN emulation) on the interface. If you do not intend to configure any switched features on this interface (that is, you want this interface to run only PVCs), disabling this parameter makes additional system resources available.
Instructions:	Accept the default, Enable, if you want to enable signaling on this interface. Set the state to Disable if you want to disable signaling on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.1.1.16

Parameter:	**Use Hardware MAC Address**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies whether or not to use the hardware MAC address for this interface. When enabled, the Configuration Manager uses the ATM hardware MAC address of the link module for the endstation identifier when automatically generating the user part (suffix) of an SVC service record ATM address. When disabled, the Configuration Manager uses the value specified in the MAC Address Override parameter to define the endstation identifier when automatically generating the user part (suffix) of an SVC service record ATM address.
Instructions:	Accept the default, Enable, if you want to use the MAC address of the ATM interface when automatically generating the endstation identifier portion of the ATM address user part. Set this parameter to Disable if you want to use the MAC Address Override value when automatically generating the endstation identifier portion of the ATM address user part. If you set this parameter to Disable, you must enter a value for the MAC Address Override parameter.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.1.1.18

Parameter:	**MAC Address Override**
Default:	None
Options:	Any valid MAC address
Function:	Redefines the hardware MAC address for this interface. Also defines the endstation identifier for this interface when automatically generating the user part (suffix) of an SVC service record ATM address. Using the MAC Address Override parameter is very helpful when you want to “hot-swap” ATM link modules. For example, when “hot-swapping” ATM link modules, you can enter the MAC address of the original ATM link module as the MAC Address Override value for the new ATM link module. This allows you to keep the information you have already configured on the existing ATM link module while maintaining the integrity of the existing client information on the network.
Instructions:	Enter a valid MAC address.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.1.1.19

Chapter 9
Editing ATM Signaling and ILMI Parameters

Once you enable an ATM circuit, you can use the Configuration Manager to edit ATM signaling and ILMI parameters.

Note: *To edit ATM parameters, you must first enable ATM on the router. If you have not yet enabled an ATM interface, or if you want to enable additional ATM interfaces, go to Chapter 6 for instructions.*

For each ATM signaling and ILMI parameter, this chapter describes

- The default setting
- All valid parameter options
- The parameter function
- Instructions for setting the parameter
- The MIB object ID

Begin from the Edit ATM Connector window (Figure 9-1). For instructions on how to access the Edit ATM Connector window, refer to Chapter 7.

Figure 9-1. Edit ATM Connector Window

Editing ATM Signaling Attributes

The ATM signaling attributes define how the ATM interface communicates within the ATM network.

To edit ATM signaling parameters:

1. **In the Edit ATM Connector window (refer to Figure 9-1), click on ATM Signaling.**

   The ATM Signaling Parameters window opens (Figure 9-2).

Figure 9-2. ATM Signaling Parameters Window

2. **Click on the interface that you want to edit.**

   The settings for that interface appear in the boxes next to each parameter.

3. **Assign values to the configuration parameters.**

   Refer to the following section for guidelines.

4. **Click on Apply.**

   The Configuration Manager updates the configuration file.

ATM Signaling Parameter Descriptions

Use the following descriptions when editing the parameters in the ATM Signaling Parameters window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables ATM signaling on this interface.
Instructions:	Accept the default, Enable, if you want signaling to remain enabled on this interface. Set to Disable if you do not want signaling enabled on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.2

Note: *When you disable signaling on the interface, the ATM Service Record Parameters window automatically sets the Data Encapsulation Type parameter to* LLC/SNAP *and the Virtual Connection Type parameter to* PVC.

Parameter:	**Max Number of SVC Applications**
Default:	20
Range:	1 to 32767
Function:	Identifies the maximum number of service access points (SAPs) allowed for this circuit. The number of SAPs corresponds to the number of LAN emulation or IP (RFC 1577) clients allowed for the circuit.
Instructions:	Accept the default, 20, or enter a value from 1 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.6

Parameter:	**Max Point to Point Connections**
Default:	1000
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous point-to-point connections allowed for this circuit.
Instructions:	Accept the default, 1000, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.7

Parameter:	**Max Point to Multipoint Connections**
Default:	40
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous point-to-multipoint connections allowed for this circuit.
Instructions:	Accept the default, 40, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.8

Parameter:	**Max Parties in Multipoint Connections**
Default:	1
Range:	0 to 32767
Function:	Identifies the maximum number of simultaneous parties in a point-to-multipoint connection allowed for this circuit.
Instructions:	Accept the default, 1, or enter a value from 0 to 32767.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.9

Parameter:	**Min Memory Threshold**
Default:	20%
Options:	10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100%
Function:	Defines the minimum percentage of buffer memory necessary to enable a new call.
Instructions:	Accept the default, 20%, or select another percentage.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.11

Parameter:	**VPI**
Default:	0
Range:	0 to 255
Function:	Defines the virtual path identifier (VPI) for the signaling VC. The signaling VC is a dedicated VPI/VCI pair reserved for signaling messages.
Instructions:	Accept the default value, 0, or enter a value from 0 to 255.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.13

Caution: *The signaling VC (0/5) and the ILMI VC (0/16) are reserved. These VCs remain in an operational state as long as signaling is enabled on the ATM interface. Because most ATM devices use these VPI/VCI pairs for signaling, we recommend that you not change these values.*

Parameter:	**VCI**
Default:	5
Range:	1 to 65535
Function:	Defines the virtual channel identifier (VCI) for the signaling VC. The signaling VC is a dedicated VPI/VCI pair reserved for signaling messages.
Instructions:	Accept the default, 5, or enter a value from 1 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.14

Caution: *The signaling VC (0/5) and the ILMI VC (0/16) are reserved. These VCs remain in an operational state as long as signaling is enabled on the ATM interface. Because most ATM devices use these VPI/VCI pairs for signaling, we recommend that you not change these values.*

Parameter:	**T303**
Default:	4
Range:	1 to 24
Function:	Defines the Setup Sent timer value (in seconds). This timer begins when the circuit initiates a call/connection request by sending a SETUP message over the signaling VC. The Setup Sent timer stops when the circuit receives either a CONNECT message (indicating connection), CALL PROCEEDING message (indicating that the network received the SETUP message), or RELEASE COMPLETE message (indicating the rejection of the SETUP message) from the network. If the circuit does not receive one of these messages within the allotted time, it transmits the SETUP message a second time. If the circuit still does not receive a response, it clears the connection.
Instructions:	Accept the default, 4, or enter a value from 1 to 24.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.25

Parameter:	**T308**
Default:	30
Range:	1 to 180
Function:	Defines the Release Sent timer value (in seconds). This timer begins when the circuit sends a RELEASE message to initiate clearing of an SVC. Sending this RELEASE message places the network in the Release Request state. The Release Sent timer stops when the circuit receives either a RELEASE message (that is, both the circuit and the network sent RELEASE messages at the same time) or a RELEASE COMPLETE message from the network. If the timer expires before the circuit receives one of these messages, the circuit transmits the RELEASE message a second time. If the circuit still does not receive a response, the circuit releases the call reference and begins a restart procedure.
Instructions:	Accept the default, 30, or enter a value from 1 to 180.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.26

Parameter:	**T309**
Default:	10
Range:	1 to 540
Function:	Defines the SAAL Data Link Connect timer value (in seconds). This timer begins when a Signaling AAL malfunction occurs. The SAAL Data Link Connect timer stops when the circuit re-establishes SAAL (that is, when the circuit sends an AAL-ESTABLISH-REQUEST and receives an AAL-ESTABLISH-CONFIRM message). If the timer expires before the circuit can re-establish SAAL, the circuit clears the connection.
Instructions:	Accept the default, 10, or enter a value from 1 to 540.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.27

Parameter:	**T310**
Default:	10
Range:	1 to 60
Function:	Defines the Call Proceeding Received timer value (in seconds). This timer begins when the circuit receives a CALL PROCEEDING message from the network. If the signaling does not receive a CONNECT or RELEASE message before this timer expires, it clears the connection for that virtual circuit.
Instructions:	Accept the default, 10, or enter a value from 1 to 60.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.28

Parameter:	**T313**
Default:	4
Range:	1 to 24
Function:	Defines the Connect Sent timer value (in seconds). This timer begins when the circuit sends a CONNECT message to the network. The Connect Sent timer stops when the circuit receives a CONNECT ACKNOWLEDGE message from the network (indicating the completion of the ATM connection for that interface). If the timer expires before the circuit receives a CONNECT ACKNOWLEDGE message, the circuit clears the connection.
Instructions:	Accept the default, 4, or enter a value from 1 to 24.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.29

Parameter:	**T316**
Default:	120
Range:	1 to 720
Function:	Defines the Restart Request Sent on Interface timer value (in seconds). This timer begins when the circuit sends a RESTART message to the network. The circuit uses the RESTART message to return all VCs on the interface to the idle condition. The Restart Request Sent on Interface timer stops when the circuit receives a RESTART ACKNOWLEDGE message from the network. If the timer expires before the circuit receives a RESTART ACKNOWLEDGE message, the circuit can transmit as many RESTART messages as specified with the Num Restarts Permitted parameter (refer to the parameter description later in this section). If the circuit still does not receive a response, the circuit enters the Null state until the appropriate maintenance action is taken.
Instructions:	Accept the default, 120, or enter a value from 1 to 720.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.30

Parameter:	**T316c**
Default:	120
Range:	1 to 720
Function:	Defines the Restart Request Sent on Channel timer value (in seconds). This timer begins when the circuit sends a RESTART message to the network. The circuit uses the RESTART message to return this individual VC on the interface to the idle condition. The Restart Request Sent on Channel timer stops when the circuit receives a RESTART ACKNOWLEDGE message from the network. If the timer expires before the circuit receives a RESTART ACKNOWLEDGE message, the circuit can transmit as many RESTART messages as specified with the Num Restarts Permitted parameter (refer to the parameter description later in this section). If the circuit still does not receive a response, the circuit enters the Null state until the appropriate maintenance action is taken.
Instructions:	Accept the default, 120, or enter a value from 1 to 720.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.31

Parameter: **T322**

Default: 4

Range: 1 to 24

Function: Defines the Status Enquiry Sent timer value (in seconds). This timer begins when the circuit sends a STATUS ENQUIRY message to the network. This message checks the validity of a call by requesting the call state (that is, the state of an active call, the state of a call in progress, or the Null state if the call reference does not relate to an active call or a call in progress).

The Status Enquiry Sent timer stops when the circuit receives a STATUS message from the network.

If the timer expires before the circuit receives a STATUS message, the circuit can transmit as many STATUS ENQUIRY messages as specified with the Num Stat Enquiries Permitted parameter (refer to the parameter description later in this section). If the circuit still does not receive a response, the circuit clears the call.

Instructions: Accept the default, 4, or enter a value from 1 to 24.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.7.1.32

Parameter: **TDisc**

Default: 4

Range: 1 to 180

Function: Defines the SAAL Data Link Disconnect timer value (in seconds). This internal timer alerts upper layers that the link is down. The timer begins if the entire link goes down for any reason.

When the link goes down, the SAAL layer sends a DISCONNECT REQUEST message to the upper-layer application manager. The SAAL layer sends a disconnect request every time the SAAL Data Link Disconnect timer expires and continues to send this message until the link becomes operational.

Instructions: Accept the default, 4, or enter a value from 1 to 180.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.7.1.33

Parameter:	**T398**
Default:	4
Range:	1 to 24
Function:	Defines the Drop Party Sent timer value (in seconds). This timer applies to multipoint connections only and begins when the circuit sends a DROP PARTY message to a party (the receiver of the message) on the network. The Drop Party Sent timer stops when the circuit receives a DROP PARTY ACKNOWLEDGE message (indicating that the endpoint used for the party has been released), or a RELEASE message (indicating that the endpoint used for the party has been released and there are no remaining parties).
Instructions:	Accept the default, 4, or enter a value from 1 to 24.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.34

Parameter:	**T399**
Default:	14
Range:	1 to 84
Function:	Defines the Add Party Sent timer value (in seconds). This timer applies to multipoint connections only and begins when the circuit sends an ADD PARTY message to a party (the receiver of the message) on the network. The Add Party Sent timer stops when the circuit receives an ADD PARTY ACKNOWLEDGE message (indicating the connection to the party), ADD PARTY REJECT message (indicating the inability to add the party), or a RELEASE message (indicating the inability to add the party and the absence of any remaining parties). If the timer expires before the circuit receives an ADD PARTY ACKNOWLEDGE, ADD PARTY REJECT, or RELEASE message, the circuit clears the party.
Instructions:	Accept the default, 14, or enter a value from 1 to 84.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.35

Parameter:	**Num Restarts ReXmitted**
Default:	3
Range:	1 to 100
Function:	Defines the number of RESTART messages retransmitted before the link is considered down.
Instructions:	Accept the default, 3, or enter a value from 1 to 100.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.36

Parameter:	**Num Stat Enquiries ReXmitted**
Default:	3
Range:	1 to 100
Function:	Defines the number of STATUS ENQUIRY messages retransmitted before the link is considered down.
Instructions:	Accept the default, 3, or enter a value from 1 to 100.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.37

Parameter:	**Num Messages/Sec for Call Pacing**
Default:	2
Range:	0 to 2147483647
Function:	Defines the maximum number of signaling messages the interface can transmit per second.
Instructions:	Accept the default value, 2, or enter a value from 0 to 2147483647.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.7.1.40

Editing the ATM Signaling Control VC

To edit the ATM Signaling Control VC parameters:

1. **In the Edit ATM Connector window (refer to Figure 9-1), click on ATM Signaling.**

   The ATM Signaling Parameters window opens (Figure 9-3).

Figure 9-3. ATM Signaling Parameters Window

2. **Click on the interface that you want to edit.**

   The settings for that interface appear in the boxes next to each parameter.

3. **Click on Sig VC.**

   The ATM Control VC for Signaling window opens (Figure 9-4).

Figure 9-4. ATM Control VC for Signaling Window

4. **Assign values to the signaling VC parameters.**

   Refer to the following section for guidelines.

5. **Click on Apply.**

   The Configuration Manager updates the configuration file.

ATM Control VC for Signaling Parameter Descriptions

Use the following descriptions when you set the parameters in the ATM Control VC for Signaling window.

Parameter: **Xmit Peak Cell Rate (cells/s)**

Default: 4716

Range: 300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs)
128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs)
128 to 96000 (ATM ARE DS-3 ILI pairs)
128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode)
128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)

Function: Specifies the upper traffic limit, in cells/s, that the ATM connection can submit.

How you set the peak cell rate depends on

- The optical transmission rate of your ATM device
- The amount of traffic you expect on a particular VC
- The rate you desire for each VC

Instructions: After you determine the transmission rate of your ATM device, set the peak cell rate within the range specified above.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.8

Parameter: **Xmit Sustainable Cell Rate (cells/s)**

Default: 4716

Range: 300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs)
0, 128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs)
0, 128 to 96000 (ATM ARE DS-3 ILI pairs)
0, 128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode)
0, 128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)

Function: Specifies the upper limit of the ATM connection conforming average rate. The average rate equals the total number of cells transmitted divided by the duration of the connection.

Using the sustainable cell rate (SCR), you can define the future cell flow of a VC in greater detail than by just using the peak cell rate.

For ATM FRE2 ILI pairs, specifying the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources.

For ATM ARE ILI pairs, the SCR maps directly to the minimum cell rate (MCR). The MCR defines the minimum amount of guaranteed bandwidth allowed for PVCs and Control VCs on the ATM line.

When setting the SCR for ATM FRE2 ILI pairs, keep the following in mind:

- The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VC to conform.
- To be useful, the SCR must not exceed the PCR.
- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM FRE2 ILI pairs require a minimum SCR value of 300 cells/s. PVCs may fail to operate with SCR values less than 300 cells/s.

When setting the SCR for ATM ARE ILI pairs, keep the following in mind:

- The SCR maps directly to the MCR.
- The MCR provides guaranteed bandwidth for PVCs and Control VCs while allowing sufficient bandwidth for SVCs to operate.
- To be useful, the SCR must not exceed the PCR.

- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM ARE ILI pairs require a minimum SCR value of 128 cells/s. VCs may fail to operate with SCR values less than 128 cells/s.
- ATM ARE ILI pairs allow you to enter an SCR value of 0. Entering 0 for the SCR turns off this function.
- The E-3 framing mode setting affects the maximum SCR.

Instructions: After you determine the transmission rate of your ATM device, set the sustainable cell rate within the range specified above. For ATM ARE ILI pairs, you can enter 0 to turn off this function.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.9

Parameter: **Xmit Burst Size (cells)**

Default: 40

Range: 1 to 65535

Function: For ATM FRE2 ILI pairs, the Maximum Burst Size is the maximum length of a cell stream on a particular VC. The MBS specifies the maximum number of sequential cells allowed on a VC, at the peak cell rate, before the VC must relinquish bandwidth to other VCs.

When setting the MBS, we suggest that you select a value larger than the largest packet your PVC or Control VC can transmit (that is, the Maximum AAL CPCS Transmit SDU size). For example, if your VC accepts packets that are less than 2358 bytes long (PVC default), set your MBS value between 45 and 50 cells.

Instructions: Set a value in the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.10

Note: *ATM ARE ILI pairs ignore the maximum burst size.*

Parameter:	**Maximum AAL CPCS Transmit SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the transmit direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to transmit. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.17

Parameter:	**Maximum AAL CPCS Receive SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the receive direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to receive. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.18

Editing Signaling AAL Attributes

The Signaling AAL (SAAL) attributes define the connection and timer parameters the router uses to maintain a switched connection. SAAL provides reliable transport of signaling messages within the ATM protocol reference model.

To edit Signaling AAL parameters:

1. **In the Edit ATM Connector window (refer to Figure 9-1), click on Signaling AAL (SAAL).**

   The ATM Signaling AAL Records List window opens (Figure 9-5).

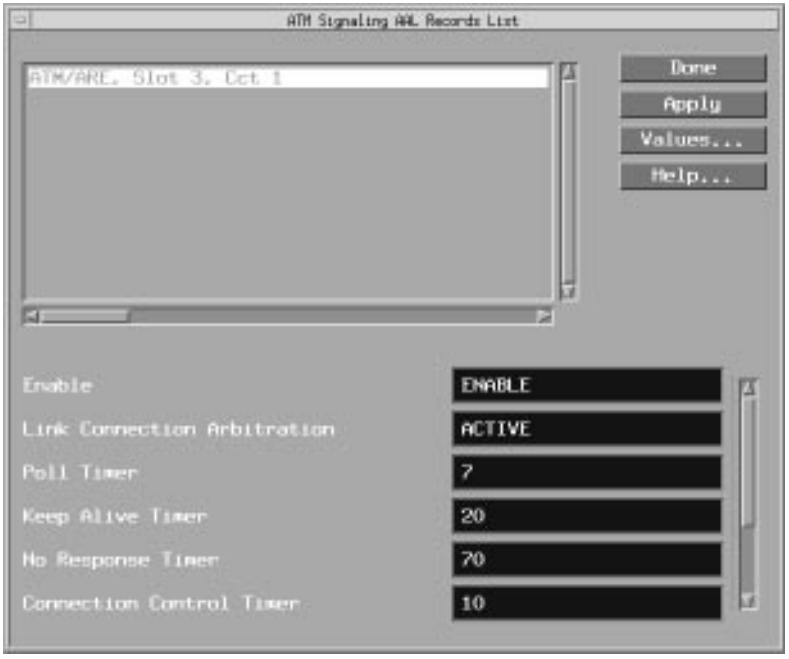


Figure 9-5. ATM Signaling AAL Records List Window

2. **Click on the interface that you want to edit.**

   The settings for that interface appear in the boxes next to each parameter.

3. **Assign values to the SAAL parameters.**

   Refer to the following section for guidelines.

4. **Click on Apply.**

   The Configuration Manager updates the configuration file.

ATM Signaling AAL Parameter Descriptions

Use the following descriptions when editing the parameters in the ATM Signaling AAL Records List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables SAAL on this interface.
Instructions:	Accept the default, Enable, if you want SAAL to remain enabled on this interface. Select Disable if you do not want SAAL enabled on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.2

Parameter:	**Link Connection Arbitration**
Default:	Active
Options:	Active | Passive
Function:	Determines whether SAAL initiates link connections or waits for connections.
Instructions:	Accept the default, Active, if you want this interface to initiate connections. Select Passive if you do not want this interface to initiate connections.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.8

Parameter:	**Poll Timer**
Default:	7
Range:	1 to 120
Function:	Defines the Service Specific Connection Oriented Protocol (SSCOP) Poll timer value (in tenths of a second). This value sets the allowable time between Poll Protocol Data Unit (PDU) transmissions. The Poll timer ensures that the receiver continues to return a solicited status (STAT) PDU to the sender on a regular basis. The timely receipt of STAT PDUs restarts the Poll timer and allows for more efficient transmission error recovery.
Instructions:	Accept the default, 7, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.9

Parameter:	**Keep Alive Timer**
Default:	20
Range:	1 to 120
Function:	Defines the SSCOP Keep Alive timer value (in tenths of a second). This value sets the allowable time between POLL PDU transmissions if there are no pending Sequence Data (SD) PDUs. The Keep Alive timer is generally greater than the Poll timer and greater than the length of one round-trip delay.
Instructions:	Accept the default, 20, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.10

Parameter:	**No Response Timer**
Default:	70
Range:	1 to 120
Function:	Defines the SSCOP No Response timer value (in tenths of a second). This value sets the allowable time between the receipt of STAT PDUs. So as not to interrupt the flow of data, the SSCOP does not require a reply to every Poll PDU. This can cause problems in detecting a broken connection. To alleviate this problem, the No Response timer runs parallel to the Poll timer. If both the No Response timer and the Poll timer expire, the SSCOP clears the connection. The No Response timer value must equal at least the sum of the Keep Alive timer plus the length of one round-trip delay.
Instructions:	Accept the default, 70, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.11

Parameter:	**Connection Control Timer**
Default:	10
Range:	1 to 120
Function:	Defines the SSCOP Connection Control (CC) timer value (in tenths of a second). This value sets the allowable time between the transmission of BGN, END, Resynchronization (RS), and Error Recovery (ER) PDUs, as long as the sender has not received an acknowledgment to any of these PDUs. The CC timer must equal at least the length of one round-trip delay.
Instructions:	Accept the default, 10, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.12

Parameter:	**Max Connection Control**
Default:	4
Range:	1 to 20
Function:	Defines the SSCOP Maximum Connection Control (CC) value. This value sets the maximum number of times the sender can transmit a BGN, END, RS, or ER PDU.
Instructions:	Accept the default, 4, or enter a value from 1 to 20.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.13

Parameter:	**Max PD Before Poll**
Default:	25
Range:	1 to 120
Function:	Defines the SSCOP Maximum Poll Data (PD) value. This value sets the maximum value of the poll data state variable before transmitting a POLL PDU. The poll data state variable increments upon transmission of a Sequenced Data (SD) PDU and resets to zero upon transmission of a POLL PDU.
Instructions:	Accept the default, 25, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.14

Parameter:	**Max STAT PDU Elements**
Default:	67
Range:	Odd integers from 3 to 119
Function:	Defines the SSCOP Maximum STAT value. This value sets the maximum number of list elements allowed in a STAT PDU. The sending device uses the value of this parameter for segmentation purposes. When the number of list elements exceeds the Max STAT value, the STAT message segments. As a general rule, the default value, 67, causes the STAT PDU to fill six ATM cells using AAL 5.
Instructions:	Accept the default, 67, or enter an odd integer from 3 to 119.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.8.1.15

Editing ILMI Attributes

The ILMI attributes define the SNMP timer and retry limits for registration with the ATM switch. To edit ILMI parameters:

1. **In the Edit ATM Connector window (refer to Figure 9-1), click on Interim Local Management Interface (ILMI).**

   The ATM ILMI Signaling Parameters window opens (Figure 9-6).

Figure 9-6. ATM ILMI Signaling Parameters Window

2. **Click on the interface that you want to edit.**

   The settings for that interface appear in the boxes next to each parameter.

3. **Assign values to the ILMI parameters.**

   Refer to the following section for guidelines.

4. **Click on Apply.**

   The Configuration Manager updates the configuration file.

ATM ILMI Signaling Parameter Descriptions

Use the following descriptions when editing the parameters in the ATM ILMI Signaling Parameters window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables ILMI on this interface.
Instructions:	Accept the default, Enable, if you want ILMI to remain enabled on this interface. Select Disable if you do not want ILMI enabled on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.2

Parameter:	**ILMI VPI**
Default:	0
Range:	0 to 255
Function:	Defines the virtual path identifier (VPI) for the ILMI VC.
Instructions:	Accept the default, 0, or enter a value from 0 to 255
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.8

Caution: *The signaling VC (0/5) and the ILMI VC (0/16) are reserved. These VCs remain in an operational state as long as signaling is enabled on the ATM interface. Because most ATM devices use these VPI/VCI pairs for signaling, we recommend that you not change these values.*

Parameter:	**ILMI VCI**
Default:	16
Range:	1 to 65535
Function:	Defines the virtual channel identifier (VCI) for the ILMI VC.
Instructions:	Accept the default, 16, or enter a value from 1 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.9

Caution: *The signaling VC (0/5) and the ILMI VC (0/16) are reserved. These VCs remain in an operational state as long as signaling is enabled on the ATM interface. Because most ATM devices use these VPI/VCI pairs for signaling, we recommend that you not change these values.*

Parameter:	**ILMI Get Timer**
Default:	3
Range:	1 to 120
Function:	Defines the ILMI Get Request timer value (in seconds). The Get Request timer sets the amount of time allowed to receive a GET_RESPONSE message after sending a GET_REQUEST message.
Instructions:	Accept the default, 3, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.13

Parameter:	**ILMI Get Retry Count**
Default:	3
Range:	1 to 100
Function:	Specifies the number of retransmissions of the ILMI GET_REQUEST message before the link is considered down.
Instructions:	Accept the default, 3, or enter a value from 1 to 100.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.14

Parameter:	**ILMI Get Next Timer**
Default:	3
Range:	1 to 120
Function:	Defines the ILMI Get Next Request timer value (in seconds). The Get Next Request timer sets the amount of time allowed to receive a GET_NEXT_RESPONSE message after sending a GET_NEXT_REQUEST message.
Instructions:	Accept the default, 3, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.15

Parameter:	**ILMI Get Next Retry Count**
Default:	3
Range:	1 to 100
Function:	Specifies the number of retransmissions of the ILMI GET_NEXT_REQUEST message before the link is considered down.
Instructions:	Accept the default, 3, or enter a value from 1 to 100.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.16

Parameter:	**ILMI Set Timer**
Default:	3
Range:	1 to 120
Function:	Defines the ILMI Set Request timer value (in seconds). The Set Request timer sets the amount of time allowed to receive a SET_RESPONSE message after sending a SET_REQUEST message.
Instructions:	Accept the default, 3, or enter a value from 1 to 120.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.17

Parameter:	**ILMI Set Retry Count**
Default:	3
Range:	1 to 100
Function:	Specifies the number of retransmissions of the ILMI SET_REQUEST message before the link is considered down.
Instructions:	Accept the default, 3, or enter a value from 1 to 100.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.9.1.18

Editing the ATM ILMI Control VC

To edit ATM ILMI VC parameters:

1. **In the Edit ATM Connector window (refer to Figure 9-1), click on Interim Local Management Interface (ILMI).**

   The ATM ILMI Signaling Parameters window opens (Figure 9-7).

Figure 9-7. ATM ILMI Signaling Parameters Window

2. **Click on the interface that you want to edit.**

   The settings for that interface appear in the boxes next to each parameter.

3. **Click on ILMI VC.**

   The ATM Control VC for ILMI window opens (Figure 9-8).

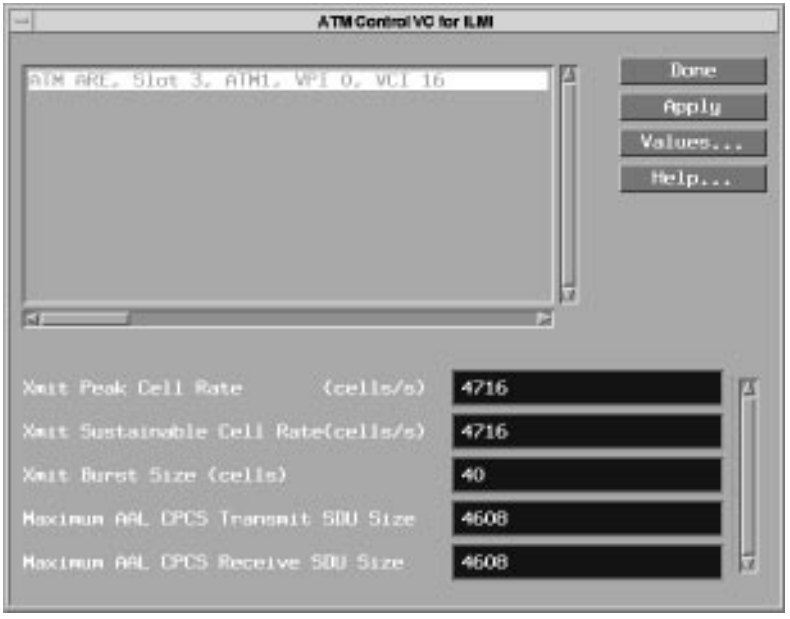


Figure 9-8. ATM Control VC for ILMI Window

4. **Assign values to the ILMI VC parameters.**

   Refer to the following section for guidelines.

5. **Click on Apply.**

   The Configuration Manager updates the configuration file.

ATM Control VC for ILMI Parameter Descriptions

Use the following descriptions when you set the parameters in the ATM Control VC for ILMI window.

Parameter: **Xmit Peak Cell Rate (cells/s)**

Default: 4716

Range: 300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs)
128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs)
128 to 96000 (ATM ARE DS-3 ILI pairs)
128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode)
128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)

Function: Specifies the upper traffic limit, in cells/s, that the ATM connection can submit.

How you set the peak cell rate depends on

- The optical transmission rate of your ATM device
- The amount of traffic you expect on a particular VC
- The rate you desire for each VC

Instructions: After you determine the transmission rate of your ATM device, set the peak cell rate within the range specified above.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.8

Parameter: **Xmit Sustainable Cell Rate (cells/s)**

Default: 4716

Range: 300 to 365566 (ATM FRE2 OC-3 SONET/SDH ILI pairs)
0, 128 to 353207 (ATM ARE OC-3 SONET/SDH ILI pairs)
0, 128 to 96000 (ATM ARE DS-3 ILI pairs)
0, 128 to 80000 (ATM ARE E-3 ILI pairs; G832 Framing Mode)
0, 128 to 72000 (ATM ARE E-3 ILI pairs; G751 Framing Mode)

Function: Specifies the upper limit of the ATM connection conforming average rate. The average rate equals the total number of cells transmitted divided by the duration of the connection.

Using the sustainable cell rate (SCR), you can define the future cell flow of a VC in greater detail than by just using the peak cell rate.

For ATM FRE2 ILI pairs, specifying the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources.

For ATM ARE ILI pairs, the SCR maps directly to the minimum cell rate (MCR). The MCR defines the minimum amount of guaranteed bandwidth allowed for PVCs and Control VCs on the ATM line.

When setting the SCR for ATM FRE2 ILI pairs, keep the following in mind:

- The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VC to conform.
- To be useful, the SCR must not exceed the PCR.
- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM FRE2 ILI pairs require a minimum SCR value of 300 cells/s. PVCs may fail to operate with SCR values less than 300 cells/s.

When setting the SCR for ATM ARE ILI pairs, keep the following in mind:

- The SCR maps directly to the MCR.
- The MCR provides guaranteed bandwidth for PVCs and Control VCs while allowing sufficient bandwidth for SVCs to operate.
- To be useful, the SCR must not exceed the PCR.

- If you know the user average rate, set the SCR about 10 percent higher than this value.
- ATM ARE ILI pairs require a minimum SCR value of 128 cells/s. VCs may fail to operate with SCR values less than 128 cells/s.
- ATM ARE ILI pairs allow you to enter an SCR value of 0. Entering 0 for the SCR turns off this function.
- The E-3 framing mode setting affects the maximum SCR.

Instructions: After you determine the transmission rate of your ATM device, set the sustainable cell rate within the range specified above. For ATM ARE ILI pairs, you can enter 0 to turn off this function.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.9

Parameter: Xmit Burst Size (cells)

Default: 40

Range: 1 to 65535

Function: For ATM FRE2 ILI pairs, the Maximum Burst Size is the maximum length of a cell stream on a particular VC. The MBS specifies the maximum number of sequential cells allowed on a VC, at the peak cell rate, before the VC must relinquish bandwidth to other VCs.

When setting the MBS, we suggest that you select a value larger than the largest packet your PVC or Control VC can transmit (that is, the Maximum AAL CPCS Transmit SDU size). For example, if your VC accepts packets that are less than 2358 bytes long (PVC default), set your MBS value between 45 and 50 cells.

Instructions: Set a value in the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.10

Note: *ATM ARE ILI pairs ignore the maximum burst size.*

Parameter:	**Maximum AAL CPCS Transmit SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the transmit direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to transmit. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.17

Parameter:	**Maximum AAL CPCS Receive SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VC supports in the receive direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VC to receive. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.18

Appendix A
Site Manager Default Settings for ATM

This appendix lists the Site Manager default parameter settings for ATM DXI and ATM. Use the Configuration Manager to edit any default settings listed here.

Table A-1. ATM DXI Interface List Window

Parameter	Default
Enable	Enable
Interface Description	None
DXI Mode	Mode 1A
Max number of VCs	512
Multiprotocol Encapsulation	RFC 1483 Style MPE
CS PDU Encapsulation	AAL5 Encapsulation
Multicast	Disable
LMI Enable	Enable

Table A-2. ATM DXI Virtual Circuit Window

Parameter	Default
VPI Number	None
VCI Number	None

Table A-3. ATM DXI PVC List Window

Parameter	Default
Enable	Enable
Mode	Group Access
Multiprotocol Encapsulation	RFC 1483 Style
CS PDU Encapsulation	AAL5 Encapsulation
Multicast	Unicast

Table A-4. Initial ATM Signaling Config Window

Parameter	Default
Enable ATM Signaling	Enable
Max Number of SVC Applications	20
Max Point to Point Connections	1000
Max Point to Multipoint Connections	40
Max Parties in Multipoint Connections	1

Table A-5. ATM Service Records List Window

Parameter	Default
Enable/Disable	Enable
User Part Autogeneration	Enable
ATM Addr User Part	None
ATM Addr Net Prefix (Optional)	None
MTU	4608

Table A-6. ATM Service Record Parameters Window

Parameter	Default
Data Encapsulation Type	LANE 802.3 (signaling enabled) or LLC/SNAP (signaling disabled)
Virtual Connection Type	SVC (signaling enabled) or PVC (signaling disabled)
User Part Autogeneration	Enable
ATM Addr User Part	None
ATM Addr Net Prefix (Optional)	None
Emulated LAN Name	Default LAN

Table A-7. ATM Virtual Channel Link Window

Parameter	Default
Hybrid/Bridged VC	No
Administrative State	Up
Xmit Peak Cell Rate (cells/s)	2358
Xmit Sustainable Cell Rate (cells/s)	2358
Xmit Burst Size (cells)	40
Maximum AAL CPCS Transmit SDU Size	4608
Maximum AAL CPCS Receive SDU Size	4608
Data Encapsulation Type	LLC/SNAP

Table A-8. ATM Virtual Channel Link Parameters Window

Parameter	Default
VPI Number	None
VCI Number	None

Table A-9. LAN Emulation Parameters Window

Parameter	Default
Enable	Enable
Owner	None
Configuration Mode	Automatic
LEC LAN Type	Unspecified
Maximum Data Frame Size	Unspecified
ELAN Name	None
LE Server ATM Address	None
Control Timeout	5
Max Unknown Frame Count	1
Max Unknown Frame Time	1
VCC Timeout Period Enable	Enable
Max Retry Count	1
Aging Time	300
Forward Delay Time	15
Expected LE_ARP Response Time	3
Flush Timeout	4
Path Switching Delay	6
Flush Protocol	Enable
LE Config Server ATM Address	None

Table A-10. ATM Interface Attributes Window

Parameter	Default
Administrative State	Up
Enable ATM Signaling	Enable
Use Hardware MAC Address	Enable
MAC Address Override	None

Table A-11. ATM Signaling Parameters Window

Parameter	Default
Enable	Enable
Max Number of SVC Applications	20
Max Point to Point Connections	1000
Max Point to Multipoint Connections	40
Max Parties in Multipoint Connections	1
Min Memory Threshold	20%
VPI	0
VCI	5
T303	4
T308	30
T309	10
T310	10
T313	4
T316	120
T316c	120
T322	4
TDisc	4
T398	4
T399	14
Num Restarts Permitted	3
Num Stat Enquiries Permitted	3
Num Messages/Sec for Call Pacing	2

Table A-12. ATM Control VC for Signaling Window

Parameter	Default
Xmit Peak Cell Rate (cells/s)	4716
Xmit Sustainable Cell Rate (cells/s)	4716
Xmit Burst Size (cells)	40
Maximum AAL CPCS Transmit SDU Size	4608
Maximum AAL CPCS Receive SDU Size	4608

Table A-13. ATM Signaling AAL Records List Window

Parameter	Default
Enable	Enable
Link Connection Arbitration	Active
Poll Timer	7
Keep Alive Timer	20
No Response Timer	70
Connection Control Timer	10
Max Connection Control	4
Max PD Before Poll	25
Max Stat PDU Elements	67

Table A-14. ATM ILMI Signaling Parameters Window

Parameter	Default
Enable	Enable
ILMI VPI	0
ILMI VCI	16
ILMI Get Timer	3
ILMI Get Retry Count	3
ILMI Get Next Timer	3
ILMI Get Next Retry Count	3
ILMI Set Timer	3
ILMI Set Retry Count	3

Table A-15. ATM Control VC for ILMI Window

Parameter	Default
Xmit Peak Cell Rate (cells/s)	4716
Xmit Sustainable Cell Rate (cells/s)	4716
Xmit Burst Size (cells)	40
Maximum AAL CPCS Transmit SDU Size	4608
Maximum AAL CPCS Receive SDU Size	4608

Table A-16. ATM ARP Configuration Window

Parameter	Default
ATM ARP Mode	Client
ARP Server ATM Address Network Prefix	None
ARP Server ATM Address User Part	None

Appendix B
ATM LAN Emulation Overview

This appendix provides general information about LAN emulation as described by the ATM Forum. For more information about LAN emulation, refer to the ATM Forum document *LAN Emulation Over ATM* (Version 1.0).

Refer to Appendix D for instructions on configuring an ATM router for LAN emulation.

LAN Emulation Basics

LAN emulation allows virtual communication of traditional LAN devices and applications over an ATM network. An ATM network can run one or more emulated LANs. However, each emulated LAN is independent of the others and devices cannot communicate directly across emulated LAN boundaries.

Note: *Communication between emulated LANs is possible through routers and bridges only (possibly implemented in the same endstation).*

LAN Emulation Connectivity

An emulated LAN can provide Ethernet (IEEE 802.3) or Token Ring (IEEE 802.5) connectivity. With an emulated Ethernet or Token Ring network over ATM, software applications can interact as if they were connected to a traditional LAN.

Note: *Bay Networks routers currently provide only Ethernet (IEEE 802.3) emulated LAN connectivity.*

LAN Emulation Components

Each emulated LAN comprises a group of LAN emulation clients and three different servers. These servers include a LAN emulation configuration server, an LE server and a broadcast and unknown server. Each of these servers provides a specific LAN emulation service.

LAN Emulation Clients

The LAN emulation client (LE client or LEC) is the interface, or virtual portion of an interface, through which an endstation forwards data, resolves addresses, and provides other control functions. The LE client provides the MAC-level emulated Ethernet or Token Ring service interface to the higher-level software. It also controls the LAN emulation UNI (LUNI) interface when communicating with other devices on the emulated LAN.

LAN Emulation Configuration Server

The LAN emulation configuration server (LECS) assigns individual LE clients to different emulated LANs. The LECS does this by giving the client the ATM address of the LAN emulation server (LES). This method allows you to assign a client to an emulated LAN based on the client's physical location (ATM address) or the identity of a LAN destination it represents.

The LE client uses the configuration protocol to obtain information from the LECS. This configuration protocol allows the LE client to locate the LES and set up a bidirectional control direct virtual channel connection. The LE client automatically obtains all of the necessary configuration data (including the LES address) from the LECS.

LAN Emulation Server

The LES controls and coordinates LE client access to the emulated LAN. When an LE client joins an emulated LAN, it registers its ATM address with the LES. When it obtains the ATM address of the LE client, the LES also obtains the physical location of the LE client (from the MAC address or route descriptor).

Having both the ATM addresses and the physical locations of all LE clients on the emulated LAN allows the LES to coordinate access among LE clients. In other words, other LE clients query the LES to obtain the ATM address associated with a specific MAC address or a route descriptor. After an LE client receives the ATM address of the LE client it wants to reach, the individual clients communicate directly.

Broadcast and Unknown Server

To emulate a traditional LAN, the emulated LAN must provide the connectionless data delivery characteristics of a shared network to its LE clients. This means that the emulated LAN must also be able to handle broadcast and multicast data. The broadcast and unknown server (BUS) addresses this requirement by distributing all broadcast, multicast, and unknown traffic to and from all LE clients on an emulated LAN.

For example, when an LE client sets up its initial configuration, it obtains the MAC address of the BUS from the LES. Using this MAC address, the LE client sets up a multicast send VCC to the BUS. In turn, the BUS registers the LE client as part of its emulated LAN.

To broadcast data, an LE client uses the multicast send VCC to send information to the BUS. The BUS then retransmits the data, through multiple point-to-point connections or one point-to-multipoint connection, to each LE client on the emulated LAN.

Understanding LAN Emulation States

As defined in the ATM Forum *LAN Emulation Over ATM* specification, LE clients enter various states of communication while attempting to join an emulated LAN. These states (referred to as "phases" by the ATM Forum) indicate the progress of an LE client as it establishes a connection with an emulated LAN (Figure B-1).

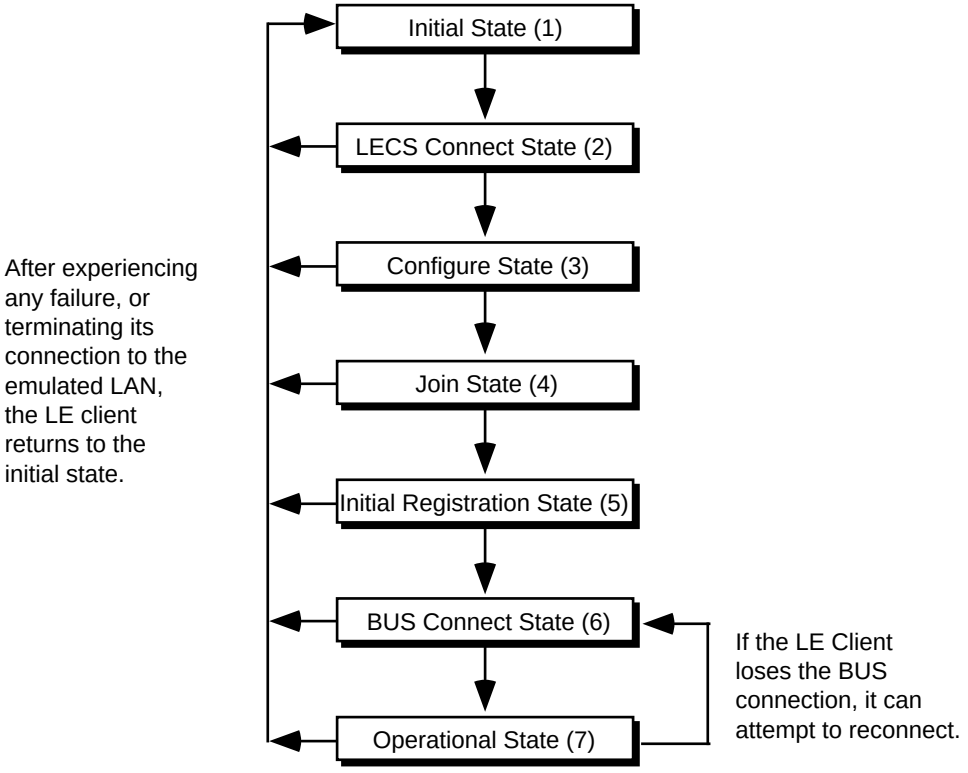

Initial State (1)
LECS Connect State (2)
Configure State (3)
Join State (4)
Initial Registration State (5)
BUS Connect State (6)
Operational State (7)
After experiencing any failure, or terminating its connection to the emulated LAN, the LE client returns to the initial state.
If the LE Client loses the BUS connection, it can attempt to reconnect.

Figure B-1. LAN Emulation States

Note: *The numbers that follow each individual state appear in the ATM LEC status record (wfAtmLecStatusEntry).*

Refer to the following sections to better understand each state.

Initial State

An LE client always starts in the Initial state before attempting to set up a connection to the LECS.

LECS Connect State

An LE client enters the LECS Connect state when it attempts to set up a connection to the LECS.

Configure State

An LE client enters the Configure state when it attempts to retrieve necessary information (that is, the ATM address of the LES, LAN type, LAN name, Maximum MTU, and various timeout values) to begin joining an emulated LAN.

Join State

An LE client enters the Join state when it attempts to join an emulated LAN. Joining an emulated LAN requires that the LE client

- Set up a control VCC to communicate with the LES
- Send a join request (containing the client MAC address) to the LES
- Accept a control distributed VCC to receive control data from the LES
- Receive a valid join response from the LES containing a LAN emulation client ID (LECID)

Note: *No more than one Bay Networks router ATM LE client can join an emulated LAN at any point in time. However, you can always move a LAN emulation client to the desired emulated LAN using network management software (for example, the Bay Networks Network Management Application software).*

Initial Registration State

An LE client enters the Initial Registration state when it attempts to register multiple MAC addresses with the LES.

Note: *The router LE client provides the MAC address only for its own ATM interface. Because it does not register multiple MAC addresses, the router never enters this state. The router LE client acts as a proxy for bridge MAC addresses not learned on this circuit.*

BUS Connect State

An LE client enters the BUS Connect state when it attempts to set up a VCC to the BUS.

Operational State

An LE client enters the Operational state after successfully completing the requirements to join an emulated LAN.

Appendix C
Configuring Classical IP over ATM

RFC 1577, “Classical IP and ARP over ATM,” is a specification for an administrative entity within an ATM network called a logical IP subnet (LIS). Bay Networks supports RFC 1577.

Each ATM LIS consists of multiple network devices — hosts and routers — connected to the ATM network and configured with interfaces to the same IP subnetwork. Each LIS operates and communicates independently of other LISs in the ATM network. A host connected to an ATM network communicates directly with other hosts in its own LIS. To communicate with hosts in other LISs, the host must use an IP router. A router can be connected to multiple LISs.

An ATM LIS must meet the following requirements as described in RFC 1577:

- All members of the LIS (hosts and routers) must have the same IP network/subnet number and address mask.
- All members must be directly connected to the ATM network, using switched virtual circuits (SVCs).
- All members must access hosts outside the LIS through a router.
- All members must be able to communicate by means of ATM with every other member of the LIS (that is, the virtual connection topology must be fully meshed).

An ATM LIS can replace an IP LAN. In Figure C-1, for example, three IP host systems and an IP router have interfaces to an Ethernet LAN. To communicate with each other on the LAN, the devices use the media access control (MAC) addresses of the LAN that they obtain via ARP or by static configuration. For communications beyond the LAN, the devices use IP addresses.

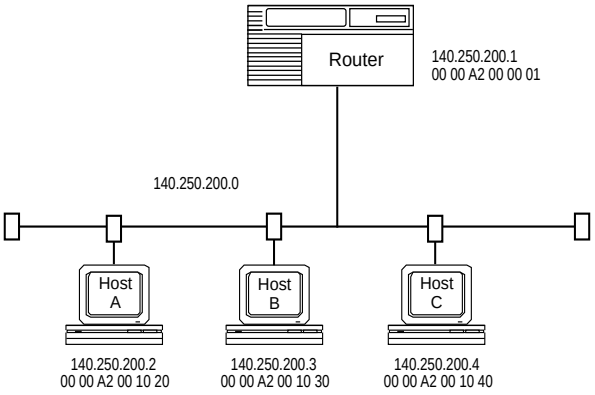


Figure C-1. IP Local Area Network

In Figure C-2, an ATM network replaces the LAN interfaces, creating a LIS. For communications within the LIS, the devices use their ATM addresses obtained via ATMARP; for communications beyond the LIS, the devices use IP addresses.

For example, to send a message to Host B, Host A uses Host B's ATM address. To send a message to a host beyond the LIS, Host A uses an IP address to identify the remote host and sends the message to the local router, using the router's ATM address. The router forwards the message.

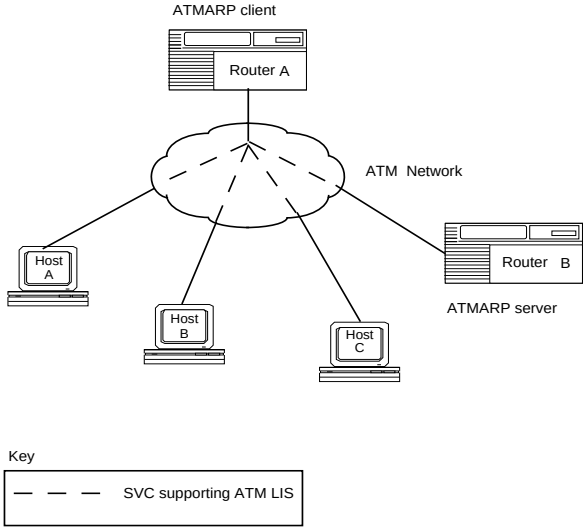


Figure C-2. IP Logical IP Subnet

ATM Address Resolution

An address resolution protocol (ARP) defines a mechanism that enables an IP router to use the IP address of a network device to learn the device's physical address. The address resolution scheme used on an Ethernet LAN is called ARP. The address resolution scheme defined by RFC 1577 for use in a LIS is called ATMARP.

On a LAN, which is a broadcast medium, a router obtains the physical address of a network device by broadcasting an ARP request. In a LIS, which uses a nonbroadcast ATM medium, a router sends an ATMARP request to an ATMARP server.

In Figure C-2, for example, each IP interface on the LIS opens a VC to the ATMARP server and registers its IP address and ATM address. The server uses this information to build and maintain a table that maps LIS IP addresses to ATM addresses.

A router that needs the ATM address of a host on the LIS sends an ATMARP request to the server. The server returns a response containing the address. The router extracts the ATM address of the host from the response and opens an SVC directly to the host via ATM UNI signaling.

If the server does not have an entry for the requested IP address, it returns a negative acknowledgment, signifying that the destination is unreachable.

Configuring an ATMARP Client and an ATMARP Server

Site Manager allows you to

- Specify SVC as the virtual circuit type. All network devices on a LIS must be connected by SVCs.
- Specify an encapsulation type for messages transmitted over the circuit. (RFC 1577 defines LLC/SNAP as the encapsulation type for ATMARP.)
- Add IP and IP routing protocols to the circuit.
- Configure ATMARP to run on the router as a client or a server.

Note: *For full compatibility with RFC 1577, you may have to specify an MTU size of 9188 bytes. Refer to* Configuring Line Services *for additional information about setting the MTU size.*

To configure an ATMARP client or server:

1. **In the Configuration Manager window, select an ATM link module, click on a connector, and name the circuit.**

   The Initial ATM Signaling Config window opens (Figure C-3).

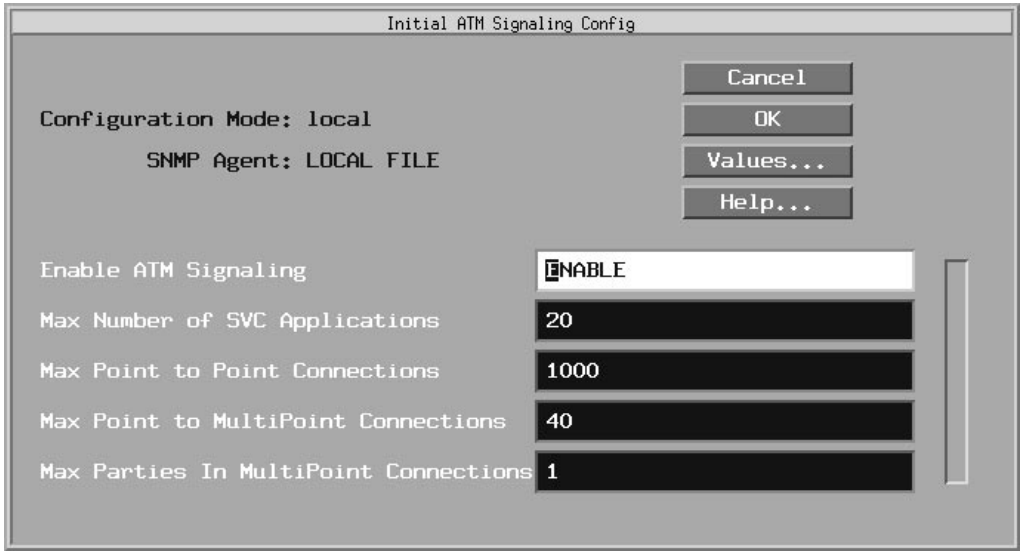


Figure C-3. Initial ATM Signaling Config Window

2. **Edit the parameters and click on OK.**

   The Edit ATM Connector window opens (Figure C-4).

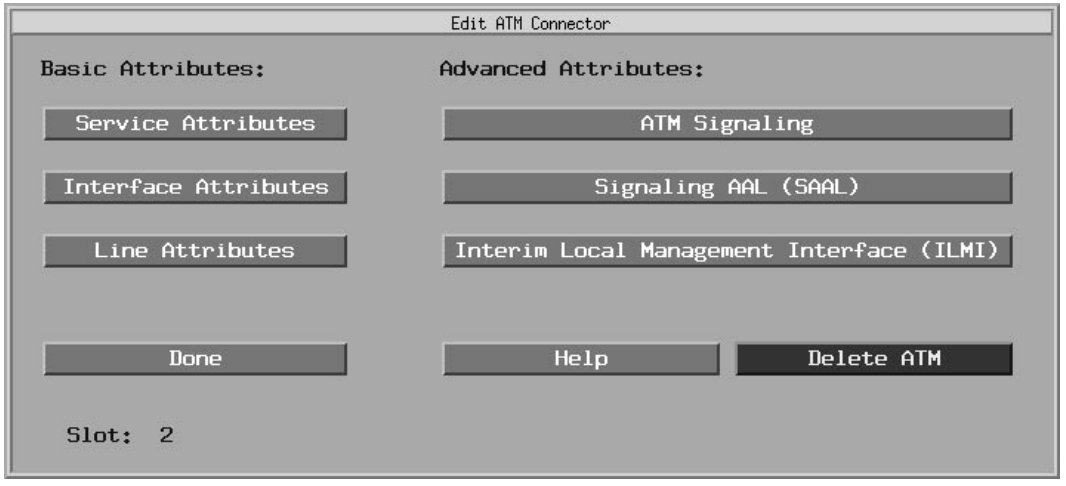


Figure C-4. Edit ATM Connector Window

3. **Click on Service Attributes.**

   The ATM Service Records List window opens.

4. **Click on Add.**

   The ATM Service Record Parameters window opens (Figure C-5).

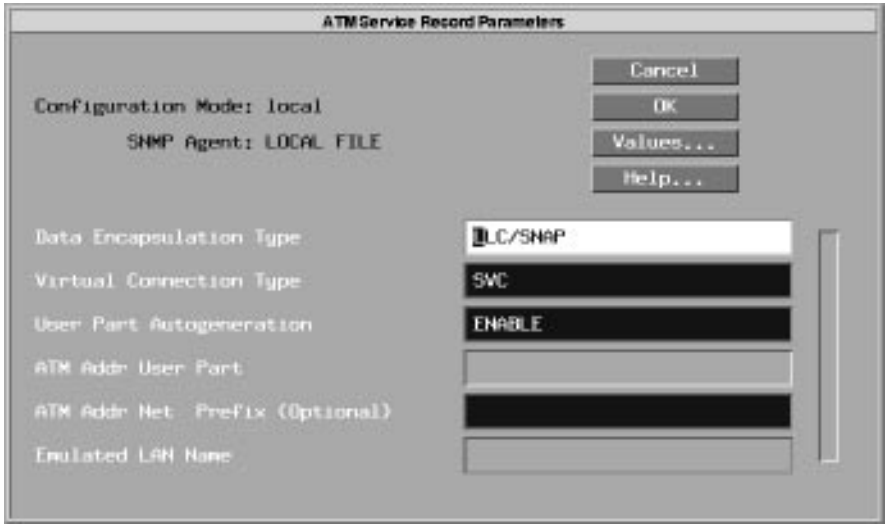


Figure C-5. ATM Service Record Parameters Window

5. **Set parameters in this window as follows:**

   a. **Specify Data Encapsulation Type LLC/SNAP.**

   b. **Set the Virtual Connection Type parameter to SVC.**

   Refer to Chapter 8 for descriptions of these parameters.

6. **Click on OK.**

   The Select Protocols window opens (Figure C-6).

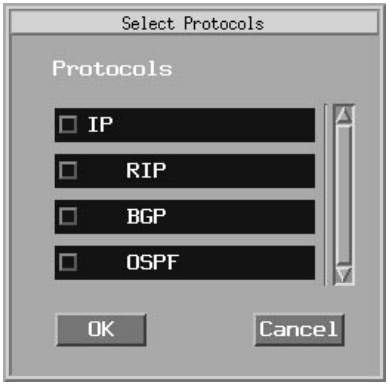


Figure C-6. Select Protocols Window for IP over ATM

7. **Select the protocols you want to add to the circuit and click on OK.**

   The IP Configuration window opens (Figure C-7).

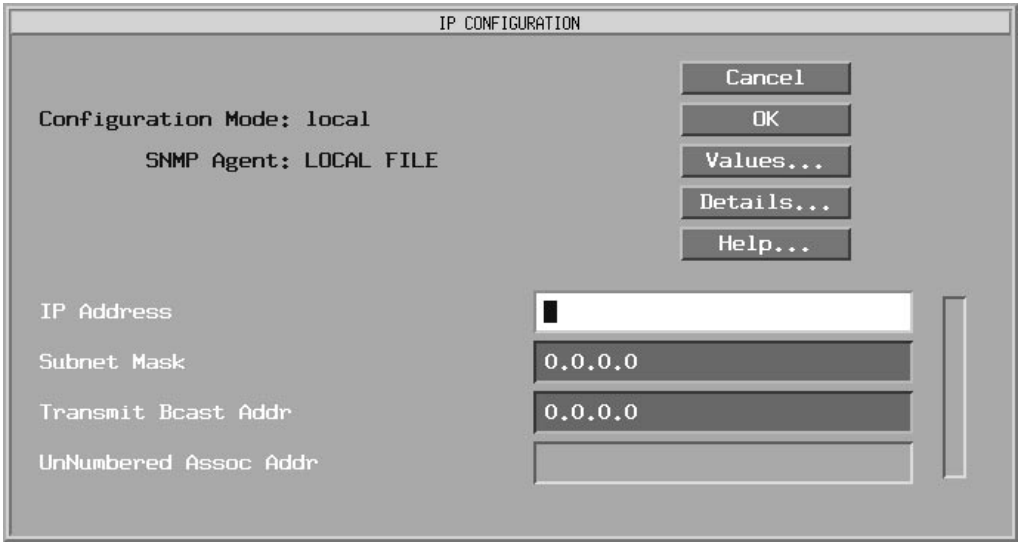


Figure C-7. IP Configuration Window for ATM

8. **Specify an IP address for the IP interface you are adding to the circuit and click on OK.**

   The ATM ARP Configuration window opens (Figure C-8).

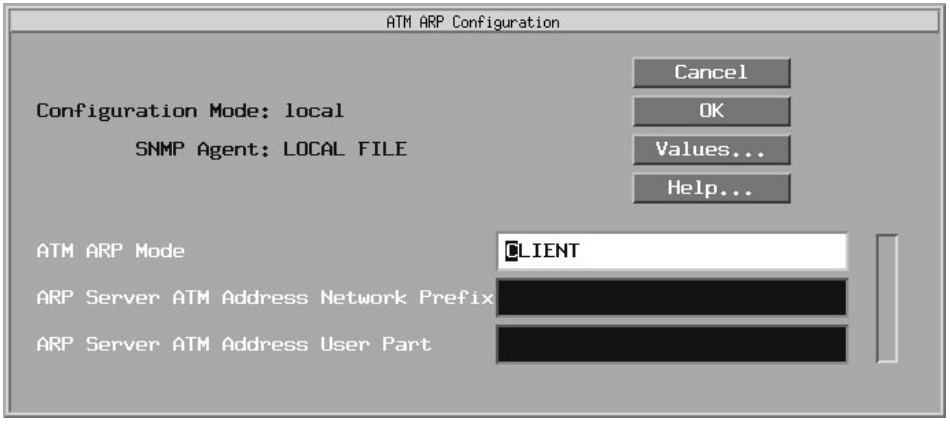


Figure C-8. ATM ARP Configuration Window

9. **Edit the parameters in the ATM ARP Configuration window.**

   Refer to the following section for guidelines.

10. **Click on OK.**

Note: *If you remove and replace a link module that is configured to act as an ATM ARP client, the client loses connectivity until the ATMARP Server Reg Interval parameter for that client expires (900 second default). This occurs only when the client is configured to autogenerate the ATM address user part (refer to Chapter 8 for additional information about ATM address user part autogeneration).*

ATM ARP Configuration Parameter Descriptions

Use the following descriptions when you edit the parameters in the ATM ARP Configuration window.

Parameter:	**ATM ARP Mode**
Default:	Client
Options:	Client | Server
Function:	Specifies whether ATM ARP is running as a client or server on this interface.
Instructions:	You must configure one ATM ARP server for each LIS you define.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.112

Parameter:	**ARP Server ATM Address Network Prefix**
Default:	None
Range:	XX00000000000000000000000 to XXFFFFFFFFFFFFFFFFFFFFFFF where XX = 39, 45, or 47
Function:	Defines the ATM address network prefix of the ATM ARP server on your network. The XX byte must contain 39, 45, or 47. These values define the Authority and Format Identifier (AFI). The AFI byte identifies the group responsible for allocating the prefix and the format the prefix uses. For more information about the AFI byte, refer to the ATM Forum UNI specification (Version 3.0). The network prefix and the user part form a complete ATM address.
Instructions:	Enter the ATM address network prefix of the ATM ARP server on your network.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

Parameter:	**ARP Server ATM Address User Part**
Default:	None
Range:	00000000000000 to FEFFFFFFFFFFFF
Function:	Defines the user part (suffix) of the ATM address for the ATM ARP server on your network. The user part suffix consists of a 6-byte endstation identifier and a 1-byte selector field. The user part and the network prefix form a complete ATM address.
Instructions:	Enter the ATM address user part of the ATM ARP server for your network.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

Configuring an ATM Address for an Adjacent Host

An *adjacent host* is a network device on the local LIS. You must configure an ATM address for all hosts on the LIS that do not implement ATMARP.

To add, edit, or delete a transmission path to an adjacent host:

1. **In the Configuration Manager window, select Protocols→IP→Adjacent Hosts.**

   The IP Adjacent Hosts window opens (Figure C-9). This window lists all adjacent hosts configured on the router.

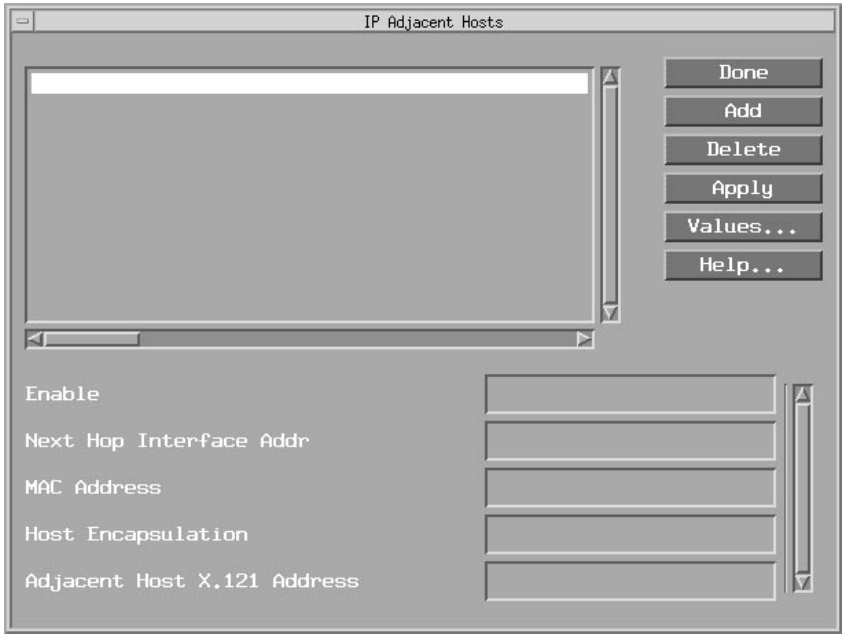


Figure C-9. IP Adjacent Hosts Window

2. **Go to the following sections to add, edit, or delete adjacent hosts.**

Adding an Adjacent Host

To add an adjacent host:

1. **In the IP Adjacent Hosts window, click on Add.**

   The IP Configuration window for adjacent hosts opens (Figure C-10).

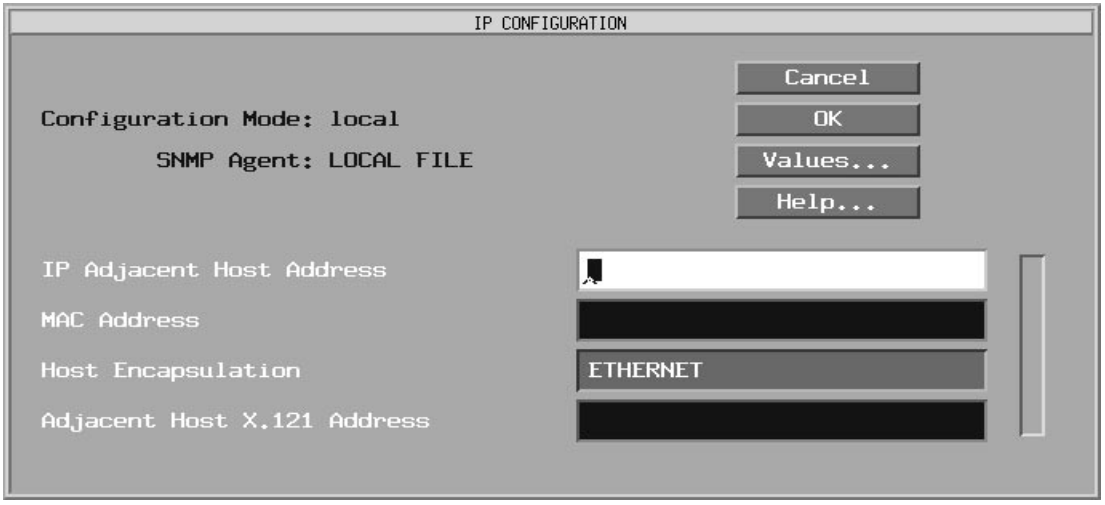


Figure C-10. IP Configuration Window for Adjacent Hosts

2. **Assign new values to the parameters that you want to edit.**

   Refer to *Configuring IP Services* for guidelines.

3. **Click on OK.**

   The Configuration Manager returns you to the IP Adjacent Hosts window (refer to Figure C-9). The window now lists the adjacent host you configured.

4. **Click on Done.**

   You return to the Configuration Manager window.

Editing Adjacent Host Parameters

You can edit the Enable, Next Hop Interface Addr, MAC Address, Adjacent Host X.121 Address, and Host Encapsulation parameters for an adjacent host.

To edit adjacent host parameters:

1. **In the IP Adjacent Hosts window (refer to Figure C-9), click on the adjacent host that you want to edit.**
2. **Edit the parameters you want to change.**

   Refer to the following section for descriptions of all the adjacent host parameters that you can edit.
3. **Click on Apply.**

   The Configuration Manager implements your changes.
4. **Click on Done.**

   You return to the Configuration Manager window.

Note: *You cannot change the adjacent host's IP address. If you want to change this parameter, you must delete the adjacent host and configure a new adjacent host with the proper IP address. For instructions, See "Deleting an Adjacent Host" on page C-16.*

Adjacent Host Parameter Descriptions

Use the following descriptions to set parameters in the IP Adjacent Hosts window and the IP Configuration window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies the state (active or inactive) of the adjacent host in the IP routing tables.
Instructions:	Select Disable to make the adjacent host record inactive in the IP routing table; the IP router will not consider this adjacent host. Select Enable to make the adjacent host record active again in the IP routing table.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.2

Parameter:	**IP Adjacent Host Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address of the device that you want to configure as an adjacent host.
Instructions:	Enter the IP address in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.3

Parameter:	**Next Hop Interface Addr**
Default:	0.0.0.0
Options:	Any valid IP address
Function:	Specifies the IP address of the router's network interface to the adjacent host.
Instructions:	Enter the IP address in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.4

Parameter:	**MAC Address**
Default:	None
Options:	Depend on the data link you have selected
Function:	Specifies the MAC address of the adjacent host. This value can be • A 48-bit physical address • A 64-bit SMDS address • An ATM VPI/VCI pair (for ATM PVCs) • The ATM address of the ATM interface (for ATM SVCs)
Instructions:	Enter the MAC address as a 12-digit hexadecimal number (canonical format), a 32-digit hexadecimal number (SMDS), a VPI/VCI pair *(*for example, 0/32), or a 40-digit ATM address (for example, 39000000000000000000000000000A20037B801).
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.6

Parameter:	**Host Encapsulation**
Default:	Ethernet
Options:	Ethernet | SNAP | PDN | DDN | SNAPIP | NULL
Function:	Specifies the adjacent host's encapsulation method.
Instructions:	Select Ethernet or SNAP (Subnetwork Access Protocol) if you are defining a point-to-point network interface, or if the adjacent host resides on an Ethernet. For an X.25 interface, select PDN or DDN. For an adjacent host on an ATM logical IP subnet, select SNAP. (SNAPIP and NULL also specify host encapsulation methods for ATM networks.)
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.7

Parameter:	**Adjacent Host X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the X.121 address of the adjacent host.
Instructions:	Ignore this parameter. You specify an X.121 address only if this is a PDN/X.25, DDN/X.25, or BFE/X.25 connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.6.1.9

Deleting an Adjacent Host

To delete an adjacent host:

1. **In the IP Adjacent Hosts window (refer to Figure C-9), click on the adjacent host you want to delete.**
2. **Click on Delete.**

   The Configuration Manager deletes the adjacent host.
3. **Click on Done.**

   You return to the Configuration Manager window.

Editing an ATMARP IP Interface

After you configure ATMARP on an IP interface, you can modify characteristics of the client or server by editing parameters in the IP Interfaces window (Figure C-11).

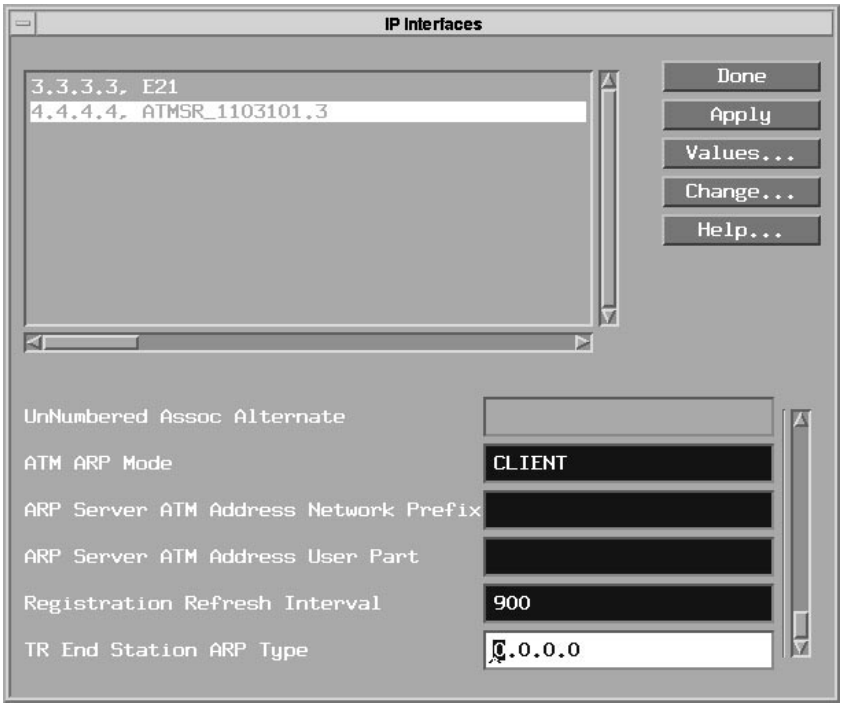


Figure C-11. IP Interfaces Window (ATM Parameters)

To edit the IP interface parameters:

1. **Select the ATM interface you want to modify.**
2. **Scroll to the bottom of the parameter list until you see the ATM-specific parameters.**
3. **Edit the parameters.**

   Refer to the following section for guidelines.
4. **Click on Done.**

IP Interface Parameter Descriptions

Use the following descriptions to set ATM-specific parameters in the IP Interfaces window.

Parameter:	**ATM ARP Mode**
Default:	Client
Options:	Client | Server
Function:	Specifies whether the router is running as an ATM client or server on this interface.
Instructions:	You must configure one ATMARP server for each LIS you define.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.112

Parameter:	**ARP Server ATM Address Network Prefix**
Default:	None
Range:	XX00000000000000000000000 to XXFFFFFFFFFFFFFFFFFFFFFF where XX = 39, 45, or 47
Function:	Defines the ATM address network prefix of the ATMARP server on your network.
Instructions:	Enter the ATM address network prefix of the ATMARP server on your network. A complete ATM address consists of a network prefix and a user part. Use the ARP Server ATM Address User Part parameter to supply the user part of the ATM address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

Parameter:	**ARP Server ATM Address User Part**
Default:	None
Range:	XX00000000000000 to FEFFFFFFFFFFFF
Function:	Defines the user part (suffix) of the ATM address for the ATM ARP server on your network. The user part suffix consists of a 6-byte endstation identifier and a 1-byte selector field.
Instructions:	Enter the user part suffix of the ATM ARP server on your network. A complete ATM address consists of a network prefix and a user part. Use the ARP Server ATM Address Network Prefix parameter to supply the network part of the ATM address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

Parameter:	**Registration Refresh Interval**
Default:	900 seconds for a client 1200 seconds for a server
Options:	Any interval (in seconds)
Function:	For a client, this parameter specifies the interval between registration refreshes. For a server, this parameter specifies the duration for which the registration is valid.
Instructions:	Determine if ATMARP is running as a client or server on this interface and enter an appropriate value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.115

Appendix D
Sample ATM Network

An ATM network often contains components — both hardware and software — that provide various forms of connectivity or necessary management functions. This appendix

- Illustrates how Bay Networks ATM hardware and software components logically fit together within a sample ATM network
- Provides basic functional descriptions of the ATM hardware and software components used in the sample network

This sample network (Figure D-1) consists of all the components necessary to fully operate an ATM network. Depending on how you configure the individual hardware and software components, you can run standard ATM PVCs and SVCs, configure logical IP subnets using RFC 1577, and create virtual LANs (VLANs) using LAN emulation.

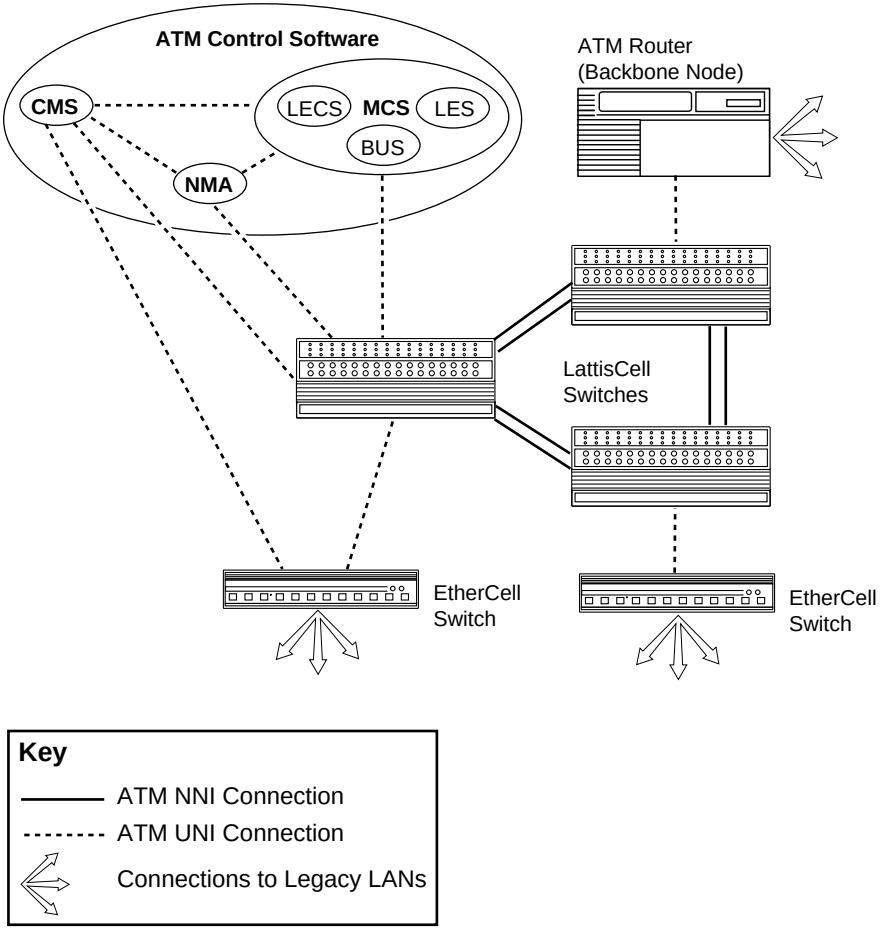


Figure D-1. Sample ATM Network

Hardware Devices

Bay Networks provides various ATM hardware devices. Each of these devices provides a different form of access within the ATM network. The ATM sample network in this appendix uses the following Bay Networks ATM hardware devices:

- LattisCell switches
- EtherCell switches
- Backbone Node containing an ATM ILI pair

In addition to the Bay Networks equipment, the example requires UNIX workstations to operate ATM network control software.

Function of the LattisCell Switch

Working in conjunction with network control software, the LattisCell switch acts as the backbone of the ATM network (refer to Figure D-1). Multiple LattisCells can interconnect using network-to-network interface (NNI) links. These interconnecting LattisCells form larger ATM networks called ATM domains.

In addition to linking together with other switches, the LattisCell can also connect to user-to-network interface (UNI) clients. UNI clients (for example, routers, hubs, servers, and workstations equipped with ATM interfaces) reside on the edge of an ATM network. Some of these UNI clients (that is, the routers, hubs, and servers) can connect to other local or wide area networks.

For additional information regarding LattisCell features and how to install and use the LattisCell, refer to *Using the Model 101xx LattisCell ATM Switch*.

Function of the EtherCell Switch

The EtherCell Ethernet-to-ATM switch connects existing Ethernet networks or endstations to ATM networks using high-speed data switching. This device supports twelve 10BASE-T Ethernet interfaces and one ATM SONET/SDH (155 Mb/s) UNI interface.

The EtherCell performs the following five primary functions:

- Registers its interfaces with the Connection Management System (CMS)
- Sets up and clears calls through the CMS
- Segments Ethernet packets into ATM cells
- Reassembles ATM cells into Ethernet packets
- Communicates with the multicast server (MCS) to coordinate virtual LAN configuration

For additional information regarding EtherCell features and how to install and use the EtherCell, refer to *Using the Model 10328-X EtherCell Ethernet-to-ATM Switch.*

Function of the Router ATM ILI Pair

ATM router link modules interact with specific processor modules to form intelligent link interface (ILI) pairs. These ILI pairs provide the connection and processing that allows the router to connect directly to an ATM network and route information to other local or wide area networks that it supports.

Bay Networks currently provides the following ATM ILI pairs:

- An ATM FRE2 link module in conjunction with a Fast Routing Engine (FRE2) processor
- An ATM Routing Engine link module in conjunction with an ATM Routing Engine (ARE) processor

Both ILI pairs are functionally similar and you configure them in generally the same way. For a list of the features each ATM ILI pair supports, refer to Chapter 5, “ATM Features and Implementation Notes.”

Understanding the Control Software

The sample ATM network consists of various control software components. Each of these components provides a necessary function within the ATM network.

Role of the CMS

The ATM CMS software provides connection services within the ATM network. Functions of the CMS include

- Managing call setup, maintenance, and clearing within a switch domain
- Negotiating network resources, a network path, and bandwidth prior to sending ATM traffic
- Ensuring that the required network resources, network path, and minimum bandwidth exist prior to sending ATM traffic
- Automatically sending calls along available paths and, in the event of a network fault, rerouting any new calls
- Collecting, combining, and filtering network management information before sending it to the ATM network management application (NMA) software
- Providing a central boot server location for a switch and other devices within the network
- Supporting ILMI, signaling (Q.2931 and Q.SAAL), Quality of Service (QoS), and Connection Admission Control (CAC) traffic management services as defined within the ATM Forum UNI Specification Version 3.0

Role of the MCS

The multicast server (MCS) software allows LAN emulation (LANE) services to operate over an ATM network. The MCS software provides the following LANE services:

- Virtual LAN definition and management
- MAC address-to-ATM address resolution for attached LANE clients
- Broadcast and multicast support for attached LANE clients

For additional information about the MCS or LANE, refer to Appendix B.

Role of the ATM NMA

The ATM NMA software provides management for any switch (including the EtherCell, LattisCell, and switch modules in the System 5000), link, or client in the ATM network.

The NMA obtains information from the CMS, MCS, or switches to display real-time views of the entire ATM network. These views provide the network manager with ATM monitoring and control information at both the switch and port level.

Refer to *Using the ATM Network Management Application 1.2* and associated release notes for more information about using the NMA in an ATM network.

Configuring the ATM Router for LAN Emulation

To configure the ATM router in this sample to connect to an emulated LAN:

1. **Display the Edit ATM Connector window (Figure D-2).**

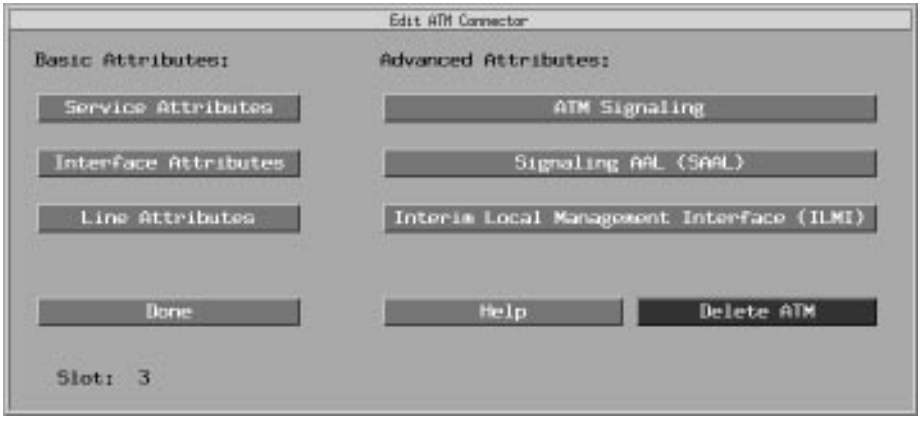


Figure D-2. Edit ATM Connector Window

2. **Click on Service Attributes.**

   The ATM Service Records List window opens (Figure D-3).

Figure D-3. ATM Service Records List Window

3. **Click on Add.**

   The ATM Service Record Parameters window opens (Figure D-4).

   The default settings for the Data Encapsulation Type parameter (LANE 802.3) and Virtual Connection Type parameter (SVC) are correct for LAN emulation. Do not edit these parameters.

Figure D-4. ATM Service Record Parameters Window

4. **Enter the appropriate ATM address components and the name of the emulated LAN that you want this LE client to join.**

   Refer to Chapter 8 for ATM service record parameter descriptions.

Note: *If you do not enter an ATM address user part, the Configuration Manager uses either the MAC address of the interface or the MAC address override value from the ATM Interface Attributes window to complete the first 6 bytes of the address. The Configuration Manager then adds a selector byte, unique to this interface, to complete the address.*

5. **Click on OK.**

   The Select Protocols window opens (Figure D-5).

Figure D-5. Select Protocols Window

6. **Click on the protocols you want to enable.**
7. **Click on OK.**

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting you for required information. If you need assistance in responding to any queries, consult the appropriate protocol-specific guide.

   When you finish configuring the protocols, the Configuration Manager returns you to the ATM Service Records List window.

8. **Click on LEC.**

   The LAN Emulation Parameters window opens (Figure D-6).

Figure D-6. LAN Emulation Parameters Window

9. **Assign values to the LAN emulation parameters that you want to edit.**

   Refer to "LAN Emulation Parameter Descriptions," in Chapter 8, for guidelines.

10. **Click on OK.**

    The Configuration Manager updates the LAN emulation parameters and returns you to the ATM Service Records List window.

Appendix E
ATM Sample Log

The following log provides an example of a working ATM LAN Emulation configuration. To generate this level of message detail, enable extended debugging in the *wfAtmSigEntry* and *wfAtmIlmiEntry* MIB objects.

Note: *The messages in this example log file may change with subsequent releases of software.*

```
[2:1]$ g wfAtmIlmiEntry.wfAtmIlmiDebug.*
wfAtmIlmiEntry.wfAtmIlmiDebug.1405101 = 6

[2:1]$ g wfAtmSscopEntry.wfAtmSscopDebug.*
wfAtmSscopEntry.wfAtmSscopDebug.1405101 = 6

[2:1]$ g wfAtmSigEntry.wfAtmSigDebug.*
wfAtmSigEntry.wfAtmSigDebug.1405101 = 6

[2:1]$ g wfAtmInterfaceConfEntry.wfAtmInterfaceDebug.*
wfAtmInterfaceConfEntry.wfAtmInterfaceDebug.1405101 = 6

[2:1]$ g wfAtmLecConfigEntry.29.3
wfAtmLecConfigEntry.wflecDebugLevel.3 = 15

[2:1]$ log -ftwifd -eATMINTF -eATM -eATM_SIG -eATM_LE

#1: 11/03/95 11:44:48.652  INFO    SLOT  5 ATMINTF        Code:  11
Coprocessor image atmc.exe loaded on link module (26334 bytes).

#2: 11/03/95 11:44:48.660  DEBUG   SLOT  5 ATMINTF        Code: 167
Port 1: framer up. (id/type 0x30)

#3: 11/03/95 11:44:48.660  INFO    SLOT  5 ATMINTF        Code:  14
Port 1: framer device initialization complete.
```

```
#4: 11/03/95 11:44:49.617  INFO    SLOT  5  ATMINTF        Code:  3
Service initializing.

#5: 11/03/95 11:44:50.605  WARNING  SLOT  5  ATMINTF        Code: 20
Port 1: not verified with diagnostic.

#6: 11/03/95 11:44:50.609  DEBUG   SLOT  5  ATMINTF        Code: 151
ATMizer driver control structures
   RX anchor 0x80000080, RX cmds 0x800000c0, RX log 0x800010c0
   TX anchor 0x800000a0, TX cmds 0x800012c0, TX log 0x800022c0

#7: 11/03/95 11:44:54.191  DEBUG   SLOT  5  ATMINTF        Code: 130
RX ATMizer image download complete

#8: 11/03/95 11:44:54.480  DEBUG   SLOT  5  ATMINTF        Code: 131
TX ATMizer image download complete

#9: 11/03/95 11:44:54.480  INFO    SLOT  5  ATMINTF        Code:  13
Port 1: SAR device initialization complete.

#10: 11/03/95 11:44:54.484 DEBUG   SLOT  5  ATMINTF        Code: 129
Using default ATMizer buffering thresholds
Port 1: cfg: ix 1405101 alm 1 frm 2 clk 1 ver 0 cct 2

#11: 11/03/95 11:44:54.484 INFO    SLOT  5  ATMINTF        Code:  4
Port 1: service available.

#12: 11/03/95 11:44:54.488 DEBUG   SLOT  5  ATMINTF        Code: 169
Port 1: cfg resets mib

#13: 11/03/95 11:44:56.335  INFO    SLOT  5  ATM_LE        Code:  2
Slot 5 : ATM Lan Emulation provided.

#14: 11/03/95 11:44:57.132  INFO    SLOT  5  ATM           Code:  1
Slot 5 : ATM Service provided.

#15: 11/03/95 11:44:57.601 INFO    SLOT  5  ATMINTF        Code:  10
Port 1: data path service available.

**************************************************************************
```

The ATM module has successfully completed its initialization process, has started, and is available for use.

```
**************************************************************************

#16: 11/03/95 11:44:57.605  DEBUG   SLOT  5  ATM           Code:  47
Signalling not loaded..Going into wait state
```

```
#17: 11/03/95 11:44:58.878  DEBUG    SLOT  5  ATM           Code:  47
Signalling came alive

#18: 11/03/95 11:44:58.882  DEBUG    SLOT  5  ATM           Code:  47
Changing to signalling wait state

#19: 11/03/95 11:44:58.882 INFO     SLOT  5  ATM_SIG        Code:   3
Line 1405101:  ATM Signaling initiating.

#20: 11/03/95 11:44:58.894 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_sig_rr: call_ref=1, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MSG

#21: 11/03/95 11:44:58.894 INFO     SLOT  5  ATMINTF        Code:  15
Port 1: virtual channel VPI=0/VCI=5 (call reference 1) activated.

#22: 11/03/95 11:44:58.894 DEBUG    SLOT  5  ATM_SIG        Code:  24
FSM atmlmst_sig_rr: call_ref=2, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MSG

#23: 11/03/95 11:44:58.898 INFO     SLOT  5  ATMINTF        Code:  15
Port 1: virtual channel VPI=0/VCI=16 (call reference 2) activated.

#24: 11/03/95 11:44:58.898 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: DP VC LINE Message
FSM atmlmst_rcp_dvl: call_ref=1, State=DP VC LINE WAIT,
Event=ATM_OPEN_VC_RESP
ATM Layer Manager Inbound: DP VC LINE Message
FSM atmlmst_rcp_dvl: call_ref=2, State=DP VC LINE WAIT,
Event=ATM_OPEN_VC_RESP
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSMatmlmst_sig_vmr:call_ref=1,State=VC_MOD_MSGWAIT,Event=VC_MOD_RSP

**************************************************************************
The VCCs for signaling (0/5) and ILMI (0/16) automatically activate.
**************************************************************************

Configuring layer 2 (Q.SAAL) - General

Configuring SAP 0 of layer 2 (Q.SAAL)

**************************************************************************
Q.SAAL is a reliable transport mechanism used by signaling (SAAL: signaling ATM
adaptation layer)
**************************************************************************
```

```
#25: 11/03/95 11:44:58.902 DEBUG    SLOT  5  ATM_SIG        Code:  24
FSMatmlmst_sig_vmr:call_ref=2,State=VC_MOD_MSGWAIT,Event=VC_MOD_RSP
Configuring layer 2 (UME) - General

Configuring SAP 0 of layer 2 (UME)

************************************************************************
```

UME refers to ILMI

```
************************************************************************

#26: 11/03/95 11:44:58.917 DEBUG    SLOT  5  ATM_SIG        Code:  24
[UME User] General Configuration

Configuring SAP 0 of layer 3

#27: 11/03/95 11:44:58.921 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: SSCOP Status Indication

#28: 11/03/95 11:44:58.925 DEBUG    SLOT  5  ATM_SIG        Code:  24
SSCOP Status Indication(su=0,ev=3,ui=3,sscf=3,sscop=3,li=3)

#29: 11/03/95 11:44:58.925 INFO     SLOT  5  ATM_SIG        Code:   5
Line 1405101:  ATM SSCOP active.

#30: 11/03/95 11:44:58.925 DEBUG    SLOT  5  ATM_SIG        Code:  24
SSCOP Status Indication: PROT_ST_UP

************************************************************************
```

Signaling uses SSCOP over VCC 0/5. Q.SAAL is composed of SSCOP and SSCS (Service Specific Convergence Sublayer). If the log message "SSCOP Status Indication:PROT_ST_DN" appears, the SSCOP process is not operating on the router and the router clears all the SVCs.

```
************************************************************************

#31: 11/03/95 11:44:58.941 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ILMI Connection Indication

#32: 11/03/95 11:44:58.949 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ILMI Connection Confirm
ATM Layer Manager Inbound: ILMI Status Indication
ILMI Status Indication (su=0,ev=3,ui=3,ume=2,li=2)

ILMI Status Indication: PROT_ST_UP
```

```
#33: 11/03/95 11:44:58.949 INFO     SLOT  5  ATM_SIG         Code:   6
Line 1405101:  ATM ILMI active.
Line 1405101:  ATM Signaling active.

**************************************************************************
```

ILMI and signaling router processes are operational, and the router has established ILMI signaling communication with the switch.

```
**************************************************************************

#34: 11/03/95 11:44:58.949  DEBUG    SLOT  5  ATM           Code:  47
Spawning PVC Manager......

**************************************************************************
```

The PVC Manager spawns whether or not you define PVCs.

```
**************************************************************************

#35: 11/03/95 11:44:58.953 DEBUG    SLOT  5  ATM_SIG         Code:  24
ATM Layer Manager Inbound: ILMI Statistics Confirm
ATM Layer Manager Inbound: ILMI Status Confirm

#36: 11/03/95 11:44:58.957 DEBUG    SLOT  5  ATM_SIG         Code:  24
ATM Layer Manager Inbound: Address Registration Request
mu_proc_addr_reg_msg(): received register request for unregistered
network prefi

#37: 11/03/95 11:44:58.957  INFO     SLOT  5  ATM           Code:   2
Line 1405101 : ATM Service activated on Interface.

#38: 11/03/95 11:44:58.960  DEBUG    SLOT  5  ATM           Code:  47
Atm Address Registration Failed
Line 1405101, cct 3, Address 00000003 00000004 00000017 00000001
00000002

#39: 11/03/95 11:44:59.039 DEBUG    SLOT  5  ATM_SIG         Code:  24
ATM Layer Manager Inbound: ILMI Add Indication

#40: 11/03/95 11:44:59.042 DEBUG    SLOT  5  ATM_SIG         Code:  24
ATM Layer Manager Inbound: Address Registration Request

#41: 11/03/95 11:44:59.210 DEBUG    SLOT  5  ATM_SIG         Code:  24
ATM Layer Manager Inbound: ILMI Add Confirm
Succeeded to register address: 39000000 00000000 00000000 000000a2
0e9fca00
```

```
#42: 11/03/95 11:44:59.210  DEBUG    SLOT  5  ATM           Code:  47
Atm Address Registration Successful
Line 1405101, cct 3, Address 39000000 00000000 00000000 000000a2
0e9fca00

**************************************************************************
```

The ATM address defined in the router ATM service record has been registered with the ATM switch. The router received the prefix 390000000000000000000000 from the switch. If you define the prefix in the service record, the prefix you define overrides what the router receives from the switch.

```
**************************************************************************

#43: 11/03/95 11:44:59.214  INFO     SLOT  5  ATM_LE         Code:  6
Line 1405101 : Circuit 3 : ATM LEC received DP_LINE message.

#44: 11/03/95 11:44:59.218  INFO     SLOT  5  ATM_LE         Code:  3
Line 1405101 : Circuit 3 : ATM LEC initializing.

#45: 11/03/95 11:44:59.308 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Bind(LE_CTRL): cct 3 bind_id 0

#46: 11/03/95 11:44:59.308 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Bind Request

#47: 11/03/95 11:44:59.312 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Outbound: Bind Request
ATM Layer Manager Outbound: Bind Confirm

#48: 11/03/95 11:44:59.312 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Bind(LE_8023_MCAST): cct 3 bind_id 2

#49: 11/03/95 11:44:59.316 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Bind Request
ATM Layer Manager Outbound: Bind Request
ATM Layer Manager Outbound: Bind Confirm

#50: 11/03/95 11:44:59.320 TRACE    SLOT  5  ATM_LE         Code:  38
Line 1405101 : Circuit 3 : ATM LEC Control SAP binding complete.
LEC: Calling SIG_Register(CPN): cct 3 bind_id 0 sig_id 1 reg_id 0

#51: 11/03/95 11:44:59.320 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request
ATM Layer Manager Outbound: Register Confirm

#52: 11/03/95 11:44:59.320 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Register(BLLI): cct 3 bind_id 0 sig_id 1 reg_id 1
```

```
#53: 11/03/95 11:44:59.320 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request

#54: 11/03/95 11:44:59.324 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Outbound: Register Confirm

#55: 11/03/95 11:44:59.324 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Transitioning into the ATM_LEC_INITIAL state for cct 3
Line 1405101 : Circuit 3 : ATM LEC MCast SAP binding complete.
LEC: Calling SIG_Register(CPN): cct 3 bind_id 2 sig_id 2 reg_id 2

#56: 11/03/95 11:44:59.324 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request
ATM Layer Manager Outbound: Register Confirm

#57: 11/03/95 11:44:59.328 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Register(BLLI): cct 3 bind_id 2 sig_id 2 reg_id 3

#58: 11/03/95 11:44:59.328 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request
ATM Layer Manager Outbound: Register Confirm

#59: 11/03/95 11:44:59.328 TRACE    SLOT  5  ATM_LE         Code:  35
Line 1405101 : Circuit 3 : ATM LEC Control SAP register confirm for
reg_id 0.
Line 1405101 : Circuit 3 : ATM LEC Control SAP register confirm for
reg_id 1.

#60: 11/03/95 11:44:59.328 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC API msg: LE Create Response from LEC #3 UserHandle 15592560 TransId
0000000

#61: 11/03/95 11:44:59.332 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#62: 11/03/95 11:44:59.332 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 3 sig_id 1
LEC: Transitioning into the ATM_LEC_LECSCONNECT state for cct 3
Line 1405101 : Circuit 3 : ATM LEC MCast SAP register confirm for
reg_id 2.
Line 1405101 : Circuit 3 : ATM LEC MCast SAP register confirm for
reg_id 3.

**************************************************************************
```

The LAN emulation code is requesting that the signaling code open up a VCC to the LECS for the Config Direct VCC.

```
**************************************************************************
```

```
#3: 11/03/95 11:44:59.332  DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=3, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS

#64: 11/03/95 11:44:59.335 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Outbound: Connect Request

#65: 11/03/95 11:44:59.917 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: SSCOP Status Indication
SSCOP Status Indication(su=0,ev=4,ui=1,sscf=0,sscop=0,li=3)
SSCOP Status Indication: PROT_ST_DN

ATM Layer Manager Inbound: Signalling Release Indication
FSMatmlmst_tri_nws:call_ref=3,State=NETWORKWAIT,Event=AMUIAMTRELIND
ATM Release request: call_ref = 3 cid = 5 vpi/vci = 0/0
ATM Layer Manager Inbound: ATM VC Release Response
ATM Layer Manager Outbound: Close Indication

#66: 11/03/95 11:44:59.917 WARNING  SLOT  5  ATM_LE         Code:  27
Line 1405101 : Circuit 3 : ATM LEC Close Indication call_ref 3 cause
value 41

#67: 11/03/95 11:44:59.921 WARNING  SLOT  5  ATM_LE         Code:  34
LEC: could not open Config Direct VCC - reason (3)

**************************************************************************
```

The LE client could not open the Config Direct VCC. Cause value 41 (in line #66) indicates a temporary failure. Cause values are defined in the "cause" section of the ATM UNI specification. In line #67, reason (3) indicates a LE client close reason was LE_SIGREASON_OTHER (probably because SSCOP is not currently operating; line 65 indicates SSCOP is not operating).

```
**************************************************************************

#68: 11/03/95 11:44:59.921 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC API msg: LE Config Response from LEC #3 UserHandle 15592560 TransId
00ef6ee

#69: 11/03/95 11:45:01.929 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#70: 11/03/95 11:45:01.929 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 4 sig_id 1
```

```
#71: 11/03/95 11:45:01.929 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=4, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS
ATM Layer Manager Outbound: Connect Request

#72: 11/03/95 11:45:01.933 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Release Indication
FSMatmlmst_tri_nws:call_ref=4,State=NETWORKWAIT,Event=AMUIAMTRELIND
ATM Release request: call_ref = 4 cid = 6 vpi/vci = 0/0
ATM Layer Manager Inbound: ATM VC Release Response
ATM Layer Manager Outbound: Close Indication

#73: 11/03/95 11:45:01.933 WARNING  SLOT  5  ATM_LE         Code:  27
Line 1405101 : Circuit 3 : ATM LEC Close Indication call_ref 4 cause
value 27
LEC: could not open Config Direct VCC - reason (3)

#74: 11/03/95 11:45:01.933 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC API msg: LE Config Response from LEC #3 UserHandle 15592560 TransId
00ef6ee

#75: 11/03/95 11:45:05.914 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#76: 11/03/95 11:45:05.914 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 5 sig_id 1

#77: 11/03/95 11:45:05.914 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=5, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS
ATM Layer Manager Outbound: Connect Request

#78: 11/03/95 11:45:05.917 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Release Indication
FSMatmlmst_tri_nws:call_ref=5,State=NETWORKWAIT,Event=AMUIAMTRELIND
ATM Release request: call_ref = 5 cid = 7 vpi/vci = 0/0
ATM Layer Manager Inbound: ATM VC Release Response
ATM Layer Manager Outbound: Close Indication

#79: 11/03/95 11:45:05.917 WARNING  SLOT  5  ATM_LE         Code:  27
Line 1405101 : Circuit 3 : ATM LEC Close Indication call_ref 5 cause
value 27
LEC: could not open Config Direct VCC - reason (3)
```

```
#80: 11/03/95 11:45:05.917 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC API msg: LE Config Response from LEC #3 UserHandle 15592560 TransId
00ef6ee

#81: 11/03/95 11:45:10.925 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: SSCOP Status Indication
SSCOP Status Indication(su=0,ev=3,ui=3,sscf=3,sscop=3,li=3)

#82: 11/03/95 11:45:10.925 INFO     SLOT  5  ATM_SIG         Code:   5
Line 1405101:  ATM SSCOP active.

#83: 11/03/95 11:45:10.925 DEBUG    SLOT  5  ATM_SIG        Code:  24
SSCOP Status Indication: PROT_ST_UP

**************************************************************************
SSCOP becomes operational again. Switched VCs can now open successfully.
**************************************************************************

#84: 11/03/95 11:45:13.929 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#85: 11/03/95 11:45:13.929 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 6 sig_id 1

#86: 11/03/95 11:45:13.929 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=6, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS
ATM Layer Manager Outbound: Connect Request

#87: 11/03/95 11:45:14.949 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Status Indication

#88: 11/03/95 11:45:14.976 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Confirm
FSM atmlmst_cing_tcc: call_ref=6, State=NETWORK WAIT,
Event=AMUIAMTCONCFM

#89: 11/03/95 11:45:14.984  INFO     SLOT  5  ATM           Code:   8
Line 1405101 : vpi/vci 0/32 has been activated.

**************************************************************************
The router successfully opened the VCC that the Config Direct VC uses.
**************************************************************************

#90: 11/03/95 11:45:14.984 INFO     SLOT  5  ATMINTF        Code:  15
Port 1: virtual channel VPI=0/VCI=32 (call reference 6) activated.
```

```
#91: 11/03/95 11:45:14.984 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSM atmlmst_cing_vmr: call_ref=6, State=VC_MOD_MSG WAIT,
Event=VC_MOD_RSP
ATM Layer Manager Outbound: Open Confirm

#92: 11/03/95 11:45:14.984 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: opened Config Direct VCC (0/32)

LEC: Control Packet -

   Opcode:     CONFIG
      Req_Type:    REQUEST

#93: 11/03/95 11:45:14.988 DEBUG    SLOT  5  ATM_LE         Code:  45
   Transaction_Id: 00fb7b60   Requestor LECID: 0000   Flags: 0000

   Lan Type:     Unspec
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 000000000000000000000000-000000000000/00
  Dest LAN: ----

   Src ATM Address:  390000000000000000000000-0000a20e9fca/00
  Src LAN:  00:00:a2:0e:9f:ca

**************************************************************************
The destination address is not complete.  However, the request is destined for
the well-known LECS address as defined in the ATM Forum "LAN Emulation Over
ATM" specification.
**************************************************************************

#94: 11/03/95 11:45:14.988 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Transitioning into the ATM_LEC_CONFIGURE state for cct 3

#95: 11/03/95 11:45:14.996 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Control pkt ... Config frame received on Control VCC (0/32)

LEC: Received pkt on Config Direct VCC

LEC: Control Packet -

   Opcode:     CONFIG
      Req_Type:   RESPONSE     Status:    SUCCESS
```

```
   Transaction_Id: 00fb7b60   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:       1516

   Lan Name: 29

   Targ ATM Address: 39000000000000000000000000-0800201a42c4/29
  Dest LAN: ----

#96: 11/03/95 11:45:15.000 DEBUG    SLOT  5  ATM_LE         Code:  45
   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  00:00:a2:0e:9f:ca

   Num TLVs: 0

LEC: LEC #3 received Config Response pkt

LEC: Config Resp: LAN name is 29

LEC:     ... Config Resp parsed successfully

**********************************************************************
```

The LE client received a response to its Config Request; this response was parsed correctly. The response contains information such as the LAN emulation server address for this LE client. The MIB object *wfAtmLecStatusEntry* contains additional information about the emulated LAN the ATM address (LE client) will join. The MIB object *wfAtmLecOperConfigEntry* contains information about the operational parameters for this LEC.

```
**********************************************************************

#97: 11/03/95 11:45:15.000 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#98: 11/03/95 11:45:15.000 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 7 sig_id 1
LEC: Transitioning into the ATM_LEC_JOIN state for cct 3

#99: 11/03/95 11:45:15.000 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response

#100: 11/03/95 11:45:15.003 DEBUG    SLOT  5  ATM_SIG       Code:  24
FSM atmlmst_cing_rr: call_ref=7, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS
ATM Layer Manager Outbound: Connect Request

#101: 11/03/95 11:45:15.949 DEBUG    SLOT  5  ATM_SIG       Code:  24
ATM Layer Manager Inbound: Signalling Connection Status Indication
```

```
#102: 11/03/95 11:45:15.968 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Confirm
FSM atmlmst_cing_tcc: call_ref=7, State=NETWORK WAIT,
Event=AMUIAMTCONCFM

#103: 11/03/95 11:45:15.972 INFO     SLOT  5  ATM            Code:   8
Line 1405101 : vpi/vci 0/33 has been activated.

#104: 11/03/95 11:45:15.972 INFO     SLOT  5  ATMINTF        Code:  15
Port 1: virtual channel VPI=0/VCI=33 (call reference 7) activated.

#105: 11/03/95 11:45:15.976 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSM atmlmst_cing_vmr: call_ref=7, State=VC_MOD_MSG WAIT,
Event=VC_MOD_RSP
ATM Layer Manager Outbound: Open Confirm

#106: 11/03/95 11:45:15.976 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: opened Control Direct VCC for LEC #3 (VP/VC 0/33)

LEC: Control Packet -

   Opcode:       JOIN
      Req_Type:    REQUEST

   Transaction_Id: 00fb7b60   Requestor LECID: 0000   Flags: 0080

   Lan Type:      802.3
    Max Frame Size:       1516

   Lan Name: 29

#107: 11/03/95 11:45:15.980 DEBUG    SLOT  5  ATM_LE         Code:  45
   Targ ATM Address: 000000000000000000000000-000000000000/00
  Dest LAN: ----

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  00:00:a2:0e:9f:ca

#108: 11/03/95 11:45:16.050 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Indication

#109: 11/03/95 11:45:16.054 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Outbound: Connection Status Request
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_ced_rr: call_ref=8, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MSG
```

```
#110: 11/03/95 11:45:16.058 INFO     SLOT  5  ATM           Code:  8
Line 1405101 : vpi/vci 0/34 has been activated.

#111: 11/03/95 11:45:16.058 INFO    SLOT  5  ATMINTF        Code: 15
Port 1: virtual channel VPI=0/VCI=34 (call reference 8) activated.

#112: 11/03/95 11:45:16.058 DEBUG    SLOT  5  ATM_SIG       Code: 24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSMatmlmst_ced_vmr:call_ref=8,State=VC_MOD_MSGWAIT,Event=VC_MOD_RSP

#113: 11/03/95 11:45:16.062 DEBUG    SLOT  5  ATM_SIG       Code: 24
ATM Layer Manager Outbound: Connect Response

#114: 11/03/95 11:45:16.070 DEBUG    SLOT  5  ATM_SIG       Code: 24
ATM Layer Manager Inbound: Signalling Connection Status Indication
FSM atmlmst_ced_tcsi: call_ref=8, State=NETWORK WAIT,
Event=AMUIAMTCNSTIND
ATM Layer Manager Outbound: Open Indication

#115: 11/03/95 11:45:16.070 DEBUG    SLOT  5  ATM_LE        Code: 45
LEC: Open call indicate (Control VCC) for LEC #3 (VP/VC 0/34)

#116: 11/03/95 11:45:16.070 DEBUG    SLOT  5  ATM_SIG       Code: 24
ATM Layer Manager Inbound: OPEN VC RESP

#117: 11/03/95 11:45:16.082 DEBUG    SLOT  5  ATM_LE        Code: 45
LEC: Received LE-JOIN Response pkt for LEC #3

LEC: Control Packet -

   Opcode:       JOIN
      Req_Type:   RESPONSE     Status:    SUCCESS

   Transaction_Id: 00fb7b60   Requestor LECID: 0050   Flags: 0080

   Lan Type:      802.3
    Max Frame Size:       1516

   Lan Name: 29

   Targ ATM Address: 39000000000000000000000000-0800201a42c4/01
  Dest LAN: ----
#118: 11/03/95 11:45:16.085 DEBUG    SLOT  5  ATM_LE        Code: 45
   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  00:00:a2:0e:9f:ca
```

```
#119: 11/03/95 11:45:16.085 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: LEC #3 successfully joined LAN 29 (LECID = 0050)

**************************************************************************
```

The LEC has opened a Control Direct VC, transmitted a join request, received an open indication for the Control Distribute VC, and received a join response from the LES of the emulated LAN. The LEC has successfully joined the emulated LAN.

```
**************************************************************************

#120: 11/03/95 11:45:16.085 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC API msg: LE Event Response from LEC #3 UserHandle 15592560 TransId
00000000
      LAN Emulation MAC Service Up Event from LEC #16308

LEC API msg: LE Config Response from LEC #3 UserHandle 15592560 TransId
00edec7

#121: 11/03/95 11:45:16.085 INFO     SLOT  5  ATM_LE         Code:   4
Line 1405101 : Circuit 3 : ATM LEC configuration complete.

#122: 11/03/95 11:45:16.085 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Control Packet -

#123: 11/03/95 11:45:16.089 DEBUG    SLOT  5  ATM_LE         Code:  45
   Opcode:        ARP
      Req_Type:    REQUEST

   Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 000000000000000000000000-000000000000/00
  Dest LAN: ff:ff:ff:ff:ff:ff

   Src ATM Address:  390000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

**************************************************************************
```

The LE client sends an LE ARP request for the BUS using a MAC address that contains all Fs.

```
**************************************************************************

#124: 11/03/95 11:45:16.089 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Transitioning into the ATM_LEC_BUSCONNECT state for cct 3
```

```
#125: 11/03/95 11:45:16.093 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Received one of our LE-ARP Responses back for LEC #3

LEC: Control Packet -

   Opcode:        ARP
      Req_Type:   RESPONSE     Status:    SUCCESS

   Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0800201a42c4/a9

#126: 11/03/95 11:45:16.097 DEBUG    SLOT  5  ATM_LE         Code:  45
  Dest LAN: ff:ff:ff:ff:ff:ff

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

************************************************************************
The LEC has received an LE ARP response and proceeds to open up the multicast
send VCC to the BUS.
************************************************************************

#127: 11/03/95 11:45:16.097 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ

#128: 11/03/95 11:45:16.097 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 9 sig_id 2

#129: 11/03/95 11:45:16.097 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=9, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS
ATM Layer Manager Outbound: Connect Request

#130: 11/03/95 11:45:16.949 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Status Indication

#131: 11/03/95 11:45:16.980 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Confirm
FSM atmlmst_cing_tcc: call_ref=9, State=NETWORK WAIT,
Event=AMUIAMTCONCFM
```

```
#132: 11/03/95 11:45:16.984 INFO     SLOT  5  ATM           Code:  8
Line 1405101 : vpi/vci 0/35 has been activated.

#133: 11/03/95 11:45:16.984 INFO     SLOT  5  ATMINTF        Code: 15
Port 1: virtual channel VPI=0/VCI=35 (call reference 9) activated.

#134: 11/03/95 11:45:16.984 DEBUG    SLOT  5  ATM_SIG        Code: 24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSM atmlmst_cing_vmr: call_ref=9, State=VC_MOD_MSG WAIT,
Event=VC_MOD_RSP
ATM Layer Manager Outbound: Open Confirm

#135: 11/03/95 11:45:16.984 DEBUG    SLOT  5  ATM_LE         Code: 45
LEC: opened LE-802.3-Mcast VCC (0/35)

#136: 11/03/95 11:45:16.988 DEBUG    SLOT  5  ATM_LE         Code: 45
LEC API msg: LE Resolve Response from LEC #3 UserHandle 15592560 TransId
00edec

#137: 11/03/95 11:45:17.031 DEBUG    SLOT  5  ATM_SIG        Code: 24
ATM Layer Manager Inbound: Signalling Connection Indication
ATM Layer Manager Outbound: Connection Status Request

#138: 11/03/95 11:45:17.035 DEBUG    SLOT  5  ATM_SIG        Code: 24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_ced_rr: call_ref=10, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS

#139: 11/03/95 11:45:17.035 INFO     SLOT  5  ATM           Code:  8
Line 1405101 : vpi/vci 0/36 has been activated.

#140: 11/03/95 11:45:17.039 INFO     SLOT  5  ATMINTF        Code: 15
Port 1: virtual channel VPI=0/VCI=36 (call reference 10) activated.

#141: 11/03/95 11:45:17.039 DEBUG    SLOT  5  ATM_SIG        Code: 24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSM atmlmst_ced_vmr: call_ref=10, State=VC_MOD_MSG WAIT,
Event=VC_MOD_RSP
ATM Layer Manager Outbound: Connect Response

#142: 11/03/95 11:45:17.046 DEBUG    SLOT  5  ATM_SIG        Code: 24
ATM Layer Manager Inbound: Signalling Connection Status Indication

#143: 11/03/95 11:45:17.050 DEBUG    SLOT  5  ATM_SIG        Code: 24
FSM atmlmst_ced_tcsi: call_ref=10, State=NETWORK WAIT,
Event=AMUIAMTCNSTIND
ATM Layer Manager Outbound: Open Indication
```

```
#144: 11/03/95 11:45:17.050 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Multicast Fwd open call indicate for LEC #3 (VP/VC 0/36)

**************************************************************************
```

The LEC has received an open indication for the multicast forward VC and can now inform upper-layer applications that its services are available.

```
**************************************************************************

LEC API msg: LE Event Response from LEC #3 UserHandle 15592560  TransId
00000000
      Rx VCC Added Event from LEC #16308
: VCC (0/36)

#145: 11/03/95 11:45:17.050 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC RESP

#146: 11/03/95 11:45:17.132 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Bind(LE_8023_DATA): cct 3 bind_id 1

#147: 11/03/95 11:45:17.132 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Bind Request
ATM Layer Manager Outbound: Bind Request
ATM Layer Manager Outbound: Bind Confirm

#148: 11/03/95 11:45:17.136 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Transitioning into the ATM_LEC_OPERATIONAL state for cct 3
Line 1405101 : Circuit 3 : ATM LEC Data SAP binding complete.
LEC: Calling SIG_Register(CPN): cct 3 bind_id 1 sig_id 3 reg_id 4

#149: 11/03/95 11:45:17.136 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request
ATM Layer Manager Outbound: Register Confirm

#150: 11/03/95 11:45:17.140 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Register(BLLI): cct 3 bind_id 1 sig_id 3 reg_id 5

#151: 11/03/95 11:45:17.148 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Register Request

#152: 11/03/95 11:45:17.152 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Outbound: Register Confirm

#153: 11/03/95 11:45:17.160 TRACE    SLOT  5  ATM_LE         Code:  37
Line 1405101 : Circuit 3 : ATM LEC Data SAP register confirm for
reg_id 4.
Line 1405101 : Circuit 3 : ATM LEC Data SAP register confirm for
reg_id 5.
```

```
#154: 11/03/95 11:45:17.175 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Control Packet -

   Opcode:        ARP
      Req_Type:    REQUEST

   Transaction_Id: 00000001   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3

#155: 11/03/95 11:45:17.179 DEBUG    SLOT  5  ATM_LE         Code:  45
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 000000000000000000000000-000000000000/00
  Dest LAN: 00:00:a2:0d:72:e2

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----
************************************************************************
The LEC has sent an LE ARP request out for MAC address 00:00:a2:0d:72:e2.
************************************************************************

#156: 11/03/95 11:45:17.187 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Received LE-ARP Request pkt for LEC #3

LEC: Control Packet -

   Opcode:        ARP
      Req_Type:    REQUEST


   Transaction_Id: 00000001   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 000000000000000000000000-000000000000/00
  Dest LAN: 00:00:a2:0d:72:e2

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
```

```
#157: 11/03/95 11:45:17.191 DEBUG    SLOT  5  ATM_LE         Code:  45
  Src LAN:  ----

     ... not for us (LEC #3)

LEC: Received one of our LE-ARP Responses back for LEC #3

************************************************************************
```

The LES has sent the LE client a copy of the LE ARP request. The LE client drops this request because it recognizes it as its own.

The LE client receives the copy of this request from the LES because the address for which it is sending an ARP request is currently not registered with the switch. Under these circumstances, the LES forwards the ARP request to all clients that have successfully joined the emulated LAN as proxy agents.

```
************************************************************************

LEC: Control Packet -

#158: 11/03/95 11:45:17.195 DEBUG    SLOT  5  ATM_LE         Code:  45
   Opcode:        ARP
      Req_Type:   RESPONSE     Status:    SUCCESS

   Transaction_Id: 00000001   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20d72e2/00
  Dest LAN: 00:00:a2:0d:72:e2



   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

************************************************************************
```

The LE client has received an LE ARP response for the previous LE ARP request which it sent out. The LEC now knows to associate MAC address 00:00:a2:0d:72:e2 with ATM address 39000000000000000000000000-0000a20d72e2/00. The LE client now tries to open up a Data VC to the remote LEC.

```
************************************************************************

#159: 11/03/95 11:45:17.195 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: OPEN VC REQ
```

```
#160: 11/03/95 11:45:17.199 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Called SIG_Open_VC: cct 3 call_ref 11 sig_id 3

#161: 11/03/95 11:45:17.199 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_cing_rr: call_ref=11, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_M
ATM Layer Manager Outbound: Connect Request

#162: 11/03/95 11:45:17.367 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Indication
ATM Layer Manager Outbound: Connection Status Request

#163: 11/03/95 11:45:17.371 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: ATM VC Reserve Response
FSM atmlmst_ced_rr: call_ref=12, State=RESERVE WAIT,
Event=ATM_VC_RESERVE_RSP_MS

#164: 11/03/95 11:45:17.374 INFO     SLOT  5  ATM            Code:   8
Line 1405101 : vpi/vci 0/37 has been activated.

#165: 11/03/95 11:45:17.374 INFO     SLOT  5  ATMINTF        Code:  15
Port 1: virtual channel VPI=0/VCI=37 (call reference 12) activated.

#166: 11/03/95 11:45:17.374 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: VC MOD RESPONSE Message
FSM atmlmst_ced_vmr: call_ref=12, State=VC_MOD_MSG WAIT,
Event=VC_MOD_RSP
ATM Layer Manager Outbound: Connect Response

#167: 11/03/95 11:45:17.382 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: Signalling Connection Status Indication
FSM atmlmst_ced_tcsi: call_ref=12, State=NETWORK WAIT,
Event=AMUIAMTCNSTIND
ATM Layer Manager Outbound: Open Indication

#168: 11/03/95 11:45:17.382 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Data Direct open call indicate for LEC #3 (VP/VC 0/37)

#169: 11/03/95 11:45:17.386 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: Calling SIG_Close_VC: cct 3 call_ref 11 sig_id 3

#170: 11/03/95 11:45:17.386 DEBUG    SLOT  5  ATM_SIG        Code:  24
ATM Layer Manager Inbound: CLOSE VC REQ
FSMatmlmst_cv_nws:call_ref=11,State=NETWORKWAIT,Event=ATM_CLOSE_VC
ATM Release request: call_ref = 11 cid = 13 vpi/vci = 0/0
```

```
#171: 11/03/95 11:45:17.386 WARNING  SLOT  5  ATM_LE        Code:  34
LEC: incoming Data Direct call accepted - call collision drops old
pending VCC
call_ref = 11 for LEC #3

**************************************************************************
```

While opening up the Data VC the LE client noticed that the remote LE client was also trying to open a Data VC. Since this local LE client ATM address is smaller than the remote LE client ATM address, the local LE client accepts the incoming Data VC and drops the outgoing Data VC.

```
**************************************************************************

#172: 11/03/95 11:45:17.386 DEBUG    SLOT  5  ATM_LE        Code:  45
LEC API msg: LE Event Response from LEC #3 UserHandle 15592560  TransId
00000000
      Rx VCC Added Event from LEC #16308
: VCC (0/37)

#173: 11/03/95 11:45:17.386 DEBUG    SLOT  5  ATM_SIG       Code:  24
ATM Layer Manager Inbound: ATM VC Release Response
ATM Layer Manager Outbound: Release Request

#174: 11/03/95 11:45:17.390 DEBUG    SLOT  5  ATM_SIG       Code:  24
ATM Layer Manager Inbound: OPEN VC RESP

#175: 11/03/95 11:45:17.390 DEBUG    SLOT  5  ATM_LE        Code:  45
LEC: LE_READY_IND packet on (0/37) discarded

LEC: Control Packet -

   Opcode:      FLUSH
      Req_Type:    REQUEST

   Transaction_Id: 00000007   Requestor LECID: 0048   Flags: 0000

   Lan Type:     Unspec
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20e9fca/00

#176: 11/03/95 11:45:17.394 DEBUG    SLOT  5  ATM_LE        Code:  45
  Dest LAN: ----

   Src ATM Address:  39000000000000000000000000-0000a20d72e2/00
  Src LAN:  ----
```

```
LEC: Replying to received LE-FLUSH-REQUEST for LEC #3

************************************************************************
```

The remote LE client begins the flush protocol so that it can begin using the new Data VC.

```
************************************************************************

LEC: Control Packet -

   Opcode:      FLUSH
      Req_Type:   RESPONSE     Status:    SUCCESS

   Transaction_Id: 00000007   Requestor LECID: 0048   Flags: 0000

   Lan Type:     Unspec
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20e9fca/00
  Dest LAN: ----

   Src ATM Address:  39000000000000000000000000-0000a20d72e2/00
  Src LAN:  ----

************************************************************************
```

This LE client responds to the flush request since its ATM address matches the Target ATM Address.

```
************************************************************************

#177: 11/03/95 11:45:18.054 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: LE-ARP 15592614 second reverification timeout expired for LEC 3

#178: 11/03/95 11:45:18.054 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: LE-ARP reverifying batch of bindings for LEC #3

#179: 11/03/95 11:45:18.054 DEBUG    SLOT  5  ATM_LE          Code:  4
LEC:     .... destination ff:ff:ff:ff:ff:ff

LEC: Control Packet -

   Opcode:        ARP
      Req_Type:    REQUEST

   Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec
```

```
    Lan Name: -------

    Targ ATM Address: 000000000000000000000000000-000000000000/00
   Dest LAN: ff:ff:ff:ff:ff:ff

    Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
   Src LAN:  ----

LEC:     .... destination 00:00:a2:0d:72:e2

#180: 11/03/95 11:45:18.058 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Control Packet -

    Opcode:        ARP
       Req_Type:    REQUEST

    Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

    Lan Type:      802.3
     Max Frame Size:     Unspec

    Lan Name: -------

    Targ ATM Address: 000000000000000000000000000-000000000000/00
   Dest LAN: 00:00:a2:0d:72:e2

    Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
   Src LAN:  ----

#181: 11/03/95 11:45:18.062 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Received LE-ARP Request pkt for LEC #3

LEC: Control Packet -

    Opcode:        ARP
       Req_Type:    REQUEST

    Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

    Lan Type:      802.3
     Max Frame Size:     Unspec

    Lan Name: -------

    Targ ATM Address: 000000000000000000000000000-000000000000/00
   Dest LAN: 00:00:a2:0d:72:e2
```

```
   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

     ... not for us (LEC #3)

LEC: Received one of our LE-ARP Responses back for LEC #3

LEC: Control Packet -

#182: 11/03/95 11:45:18.066 DEBUG    SLOT  5  ATM_LE         Code:  45
   Opcode:        ARP
      Req_Type:   RESPONSE     Status:    SUCCESS

   Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20d72e2/00
  Dest LAN: 00:00:a2:0d:72:e2
   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

LEC: got reverification response for dest 00:00:a2:0d:72:e2 on LEC #3

LEC: Received one of our LE-ARP Responses back for LEC #3

LEC: Control Packet -

   Opcode:        ARP
      Req_Type:   RESPONSE     Status:    SUCCESS

#183: 11/03/95 11:45:18.070 DEBUG    SLOT  5  ATM_LE         Code:  45
   Transaction_Id: 00000000   Requestor LECID: 0050   Flags: 0000

   Lan Type:      802.3
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0800201a42c4/a9
  Dest LAN: ff:ff:ff:ff:ff:ff

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----
```

```
LEC: got reverification response for dest ff:ff:ff:ff:ff:ff on LEC #3

**************************************************************************
```
This LEC completes the verification of its LE ARP cache for MAC addresses ff:ff:ff:ff:ff:ff and 00:00:a2:0d:72:e2.
```
**************************************************************************

#184: 11/03/95 11:45:22.054 TRACE    SLOT  5  ATM_LE         Code:  41
LEC: LE-ARP checking timed out reverifies for LEC #3

#185: 11/03/95 11:45:22.406 DEBUG    SLOT  5  ATM_LE         Code:  42
Line 1405101 : Circuit 3 : ATM LEC ARP Table modified for MAC
0x0000a20d72e2.
Old VC (0/35) vcid = 11
New VC (0/0) vcid = 0
Sending FLUSH REQuest for MAC 0x0000a20d72e2 with id 1

**************************************************************************
```
This LEC sends a flush request and modifies the LE ARP cache so that packets destined for the MAC address 00:00:a2:0d:72:e2 temporarily drop.
```
**************************************************************************

LEC: Control Packet -

   Opcode:      FLUSH
      Req_Type:    REQUEST

#186: 11/03/95 11:45:22.410 DEBUG    SLOT  5  ATM_LE         Code:  45
   Transaction_Id: 00000001   Requestor LECID: 0050   Flags: 0000

   Lan Type:     Unspec
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20d72e2/00
  Dest LAN: ----

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

LEC: Flush packet not for LEC 3 discarded

#187: 11/03/95 11:45:22.414 DEBUG    SLOT  5  ATM_LE         Code:  45
LEC: Control Packet -

   Opcode:      FLUSH
      Req_Type:   RESPONSE     Status:    SUCCESS
```

```
   Transaction_Id: 00000001   Requestor LECID: 0050   Flags: 0000

   Lan Type:     Unspec
    Max Frame Size:     Unspec

   Lan Name: -------

   Targ ATM Address: 39000000000000000000000000-0000a20d72e2/00
  Dest LAN: ----

   Src ATM Address:  39000000000000000000000000-0000a20e9fca/00
  Src LAN:  ----

Received FLUSH RESPonse for MAC 0x0000a20d72e2 with id 1

Line 1405101 : Circuit 3 : ATM LEC ARP Table modified for MAC
0x0000a20d72e2.
Old VC (0/0) vcid = 0
New VC (0/37) vcid = 14

************************************************************************
```

This LEC receives a flush response and modifies the LE ARP cache so that packets destined for the MAC address 00:00:a2:0d:72:e2 use VPI/VCI 0/37.

```
************************************************************************
```

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